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# Physiography: Some Reflections and Trends

*Address to The Geographical Association*

J. A. STEERS

*President* 1959

THERE HAS BEEN, and perhaps still is, some difference of opinion about the meanings of physiography and geomorphology. Geomorphology is probably the more widely used word today, and means according to Webster's dictionary either "That department of physical geography which deals with the form of the earth, the general configuration of its surface, the distribution of land and water, etc.", or "The investigation of the history of geologic changes through the interpretation of topographic forms". Physiography is given three meanings in the same dictionary, one of which makes it equivalent to geomorphology, and both Webster and the Oxford dictionary equate it with physical geography. On the other hand, Huxley in his "Physiography" was very careful to distinguish between it and physical geography—at least as understood about 1869–70. In America the two words are often used as if they had the same meaning. Originally physiography included the study of the atmosphere, water, and land forms. With the growth of meteorology, climatology, and hydrology, physiography is, in practice, often limited nowadays to mean the study of land forms.

I am of the opinion that physiography is the more attractive word, and use it partly for that reason. Nevertheless it seems to me that its older and wider meaning should not be lost. It is true that we cannot now include meteorology or hydrology in full, or even in large part, if we are students of land forms. But I contend that we must include them to some extent, and sometimes in considerable detail. Hence, I find myself in close agreement with N. M. Fenneman whose two volumes on the Physiography of the Western and Eastern United States are well known. He writes in his preface that physiography is perhaps an unfortunate word, but adds "Moreover to a writer who shares the geographic interest there is a constant temptation to clothe these land forms with life by pointing out their influence on climate and life and habitation and civilization". The phrase "clothe these land forms with life" is, to my mind, very significant. Geomorphology does not exclude a consideration of, e.g., the plant cover, but it does not of itself

➤ Professor Steers delivered his address at the London School of Economics on 30th December 1959 during the Annual Conference of the Association.

include it, although it is much concerned with its effects on weathering. Physiography seems to me to be the more comprehensive word, and in my own field work I have been constantly aware of the importance of tree and plant growth, of climate, and other factors in the development of land forms, so that the wider term appeals to me far more. Many excellent textbooks seldom, if at all, emphasize the differences in land form evolution in, for instance, equatorial and temperate areas. The geographical cycle may run its course in both. W. M. Davis made allowance for climatic accidents and discussed the cycle under arid and glacial conditions.[1] Nevertheless, the differences in appearance of the landscape in the successive stages of the cycle, or the various stages of evolution if one is critical of the application of the cycle, are sufficiently different and noteworthy in well-watered lands in unlike climatic regions to deserve much greater consideration than is usually accorded them. Moreover, accumulation forms do not always receive as full treatment as erosion forms, yet they occupy vast areas of the globe, and their evolution is largely associated with plant or tree growth. On a small scale it is axiomatic that the sedimentation in a saltmarsh cannot adequately be discussed without reference to plant growth. On a large scale the natural grasslands of the world should be studied as much from the point of view of their vegetation as from that of the origin of the sediments of which they are formed. The great loess deposits illustrate this point admirably. Their formation, to say nothing of their human significance and morphometry, imply an understanding and appreciation of the conditions of grass growth during their accumulation. On the other hand, the general relationships between plant destruction and erosion are clear to all, and nearly always obtain adequate treatment. The work now being carried out, in part by geographers, on the ecology and physiography of great areas of Australia is relevant to this point. "These surveys . . . have the objectives of describing, classifying, and mapping the country, including its surface geology, topography, soils and vegetation; and of broadly assessing land-use potentialities by consideration of these inherent land characteristics in relation to the prevailing climate and possibilities of irrigation."[2]

Physiography has been, and will continue to be, approached from the viewpoint of both geologists and geographers. To the former it may perhaps be regarded as the end of a story; to the latter it is, in some aspects, a beginning. It is all to the good that there is a dual approach. It would be short-sighted to suppose that either the geologist or the geographer could cover the whole subject, which is so vast that no one need think he is ever master of the whole. Much more important is that the differences in the training given by the two subjects often imply very different ways of looking at problems. In recent years the study of the Quaternary period, the Ice Age, has developed so rapidly that it has become in practice a specialized discipline, only in part covered by the normal teaching in a department of geology. Those who

are prominent in Quaternary research are drawn from different faculties, and are building up a great store of knowledge which could not possibly accrue except from a composite approach—and much of their work is concerned with physiographical phenomena.

In a recent work on the progress of geography in France,[3] there are chapters devoted to physiographical work on the morphology of France, to desert land forms, to peri-glacial phenomena, to volcanic landscapes, to karstic relief, and to coastal features. It would be equally possible to classify work in this country, and in some others, in the same way. But I am not sure if it would do much more than call attention to the names of workers and to the subjects of their research.

I think it may be of greater interest and significance to try to indicate some of the ways in which physiographical research is developing, or has already developed, in the last few decades. Both individual and collective work is considerable, and a glance through relevant periodicals since the war will best indicate the scope and nature of the work.

We are very apt to think of knowledge under headings of, perhaps, the several disciplines listed in a handbook of university studies. It is not only convenient, but even essential that there should be these divisions. Nevertheless knowledge is one. On account of our individual limitations we can only study a part of a subject. A geographer is in both a strong and weak position in this respect. Strong, because he has a wide field of study and should thus be perhaps better able to see a problem in its general setting, and in its relations to other matters. Weak, because he cannot be expected to have a deep knowledge of all the intricacies and inter-relations of his problem with others. But, assuming for our present purpose that the problem is a physiographical one, he is, or should be, trained to make a definite contribution towards its solution, and because of his awareness of what may be called its "space relationships", he may—I do *not* say will—be in a position to evaluate the problem in terms of other disciplines, and so obtain the help of others—not, let me emphasize, merely to support him in his own conclusions, but to try and appreciate and understand the problem as a whole, and put it in its correct perspective.

The physiographer must study the ground and record facts. He must often map in detail, be prepared to make shallow bores to record the sub-soil, he must measure slopes, speeds of marine or of river currents, rate of sedimentation, movement of ice masses, and a hundred other things. I find myself in considerable agreement with R. J. Russell who is critical both of geography and of geographers and emphasizes the "development of the factual study of land forms that cuts away from classical patterns where evidence so demands". I think a glance at many recent papers on physiography published by British authors will also bear out this view. Russell is very right when he says that he has "felt that the survival of Geography as a field depends on what we do,

rather than how well we debate".[4] The standing of the subject must depend on first-rate research and proper presentation of material. It has been all to the good that largely as a result of the two world wars geographers have often been called in to work with others and to have facilities for expressing their own points of view. It is one of the themes of this address that so many problems with which geographers are vitally concerned cannot be solved by their unaided efforts—nor, let it be said, can many such problems be attacked successfully except by a team of workers. In that team the geographer should play an important part since, by his training, he should be able to act as a co-ordinator and at the same time bring to bear his especial knowledge on the problem.

It is easy to make the criticism that many papers listed in meetings of, for example, Section E of the British Association, the annual meetings of the Institute of British Geographers, or of this body, are all too parochial in outlook. I do not deny that there is occasionally some truth in this view, but it is proper to add that in many cases these papers, parochial though they may seem, present evidence of solid and sound field work on which later generalizations may have to be based. The matter may be illustrated appropriately with reference to the classifications of shorelines. The older, simpler, and generalized views of D. W. Johnson are no longer valid; the far more detailed schemes of Valentin and McGill have partly replaced them. Unquestionably these new ideas have helped a great deal, but if anyone will consider our own islands, and try to classify their coasts he will meet with no little difficulty. The south coast may be thought of, in the old nomenclature of Richthofen, as partly transverse, partly longitudinal. All of it is a drowned coast; much of it is fringed by alluvial deposits, and despite the drowning there are many evidences of raised beaches. The best examples in Britain of what are usually called barrier beaches—Scolt Head Island and related features on the coast of north Norfolk, and the Bar off Nairn in Scotland—occur the one in what would have been called a drowned coast and the other off an emerged coast. Valentin[5] classifies the Tenby and Gower peninsulas as old folded ria coasts of river-eroded lands which are now subject to marine erosion and drowned. McGill[6] puts them in his stream-eroded section of complex hills. Both Valentin and McGill are in many respects correct, but neither, largely because of the scale of the maps, can do full credit to the coast or to himself. Neither brings out that the south-facing parts of both peninsulas are what Richthofen would have called longitudinal, whereas the east and west facing parts of each are transverse, or ria, coasts.

This criticism may be regarded as unfair or petty since it can be argued that even large-scale maps cannot show small districts on a big enough scale to afford sufficient detail. On the other hand, it directs attention to the danger of generalizations, and to the importance of

detailed studies. Until we have far more knowledge of even small areas we cannot justifiably make generalizations.

There is another point worth consideration in this context. Field workers in Britain are conscious of the enormous variety of landscape in a relatively small area. They also realize that their predecessors have probably written about the place or topic they are studying. Partly for this reason new work on physiography has often to be detailed and associated with a limited area or problem. It is, therefore, from all points of view a corrective to read what is being done in those parts of the world in which little, or at the best somewhat sketchy, accounts of the physiography exist; still better let us try to visit such areas, or at any rate turn to those classics of description and analysis that are associated with the names of Powell, Dutton, Russell, Gilbert, and other writers in the United States and elsewhere.

Good detailed and analytical writing is rare. We should all do well to re-read G. K. Gilbert's memoir on the Henry Mountains, or his classic account of Lake Bonneville.[7] Without unnecessary jargon and in a clear and easy style he gives a brilliant picture of these two localities. The analysis of the mountains to demonstrate the nature of the laccolite, or the account of the various beaches and spits in Lake Bonneville could well be consulted before we write any new paper. That we know far more about laccolites and beaches than did Gilbert may or may not be true—but how many of us could present our data and make our deductions as well as Gilbert did? If we take a more modern example, it would be difficult to do better than consider Matthes' memoir on the Yosemite.[8] The grandeur of the scenery of the domes, waterfalls, rock-walls, and hanging-valleys calls not only for descriptive writing at a very high level, but also demands equally clear analysis. Experts may perhaps differ about certain interpretations, but no unbiased reader can but be envious of the grasp of the whole complex problem presented by the Yosemite landscape, and the convincing yet simple way in which it is described and explained.

In many, perhaps most, field activities in physiography, a good and appropriate survey plays an important part. The survey may have to be an original one, or it may be possible to add detail to Ordnance Survey or to corresponding maps of other countries. Frequently the physiographer must be his own surveyor, but occasionally a surveyor in his own right should be associated with the work. In so far as the problem allows, a survey adds greatly to its value since it records only facts and commonly saves a great deal of descriptive writing. In much the same way a proper understanding and use of air photography may be vital. In fact, the time is at hand when field workers should make much more use of the aeroplane in their own work. In countries such as Australia, the United States, Canada, or Brazil this is almost a *sine qua non*. Here we are sometimes apt to be shy of the expense. But ten pounds will cover about two hours' flying in a small piloted craft,

and even at 100 miles per hour it is surprising how much can be seen and recorded in that time. In fact the use of an aeroplane is not prohibitive in expense, even if privately used, if it is thought of in terms of what can be seen and done in a short time. The light already thrown upon field archaeology is sufficiently revealing to convince the most sceptical. I recently had the experience of flying at about 1000 to 1200 feet at a speed of between 110 and 120 miles per hour for nearly 800 miles over the Mississippi delta: in no other way is it at all possible to make such an adequate "appreciation" of a feature that because of its very flatness is extremely difficult to visualize at ground level.

I have already referred to the team approach to field problems. Geographers are perhaps more concerned with them than many other workers, since almost all field work involves distributions and relation of plants and animals to landforms, to climate, and to man. In this country the team approach is not new. Before the 1939–45 war there were various scientific committees or councils dealing with regional problems. The Fenland Research Committee, founded in 1932, was concerned with the nature and evolution of the Fenland. Papers, sometimes under joint authorship, dealt at length with the archaeology both in the narrow sense of excavation and analysis of finds, and in the wider sense of the nature and origin of the deposits excavated, and their relation to recent movements of sea-level. The comprehensive work of H. Godwin on pollen grains found in the peats has established on a firm basis the stratigraphical history of the area, and G. Fowler's initial work on the rivers, past and present, led to the better understanding of many minor, yet important, features on the surface. Air reconnaissance in relation both to archaeology and ecology has helped us enormously, and the historical–geographical studies of H. C. Darby demonstrated an essential part to be played by the geographer. We must also bear in mind how much physiographers owe to the continuing work of the drainage engineers and to the soil scientists. Quite apart from the importance and significance of the contribution of any one writer, there is the far greater value of joint work in enabling us to have a reasonable understanding of the district. There still remains much work to be done in the Fenland—not least that of mapping from air photographs all the features they show, and after locating these features on the ground, making whatever investigation may be possible as to their origin.

Another committee worked in the Weald. The names of Wooldridge, Bull, Kirkaldy, and others come to mind at once. Wooldridge studied not only many of the physical and structural problems of the Weald and of the London Basin but also, largely with Linton, expanded his earlier work on the high level platforms of the Weald to a much more extensive region.[9] The careful studies of river evolution and of coombe formation are two other aspects of the work of members of this

committee. It is probably fair to say that their work has been largely physiographical, and much of it was carried out by amateurs.

In a similar way a joint approach has been applied to parts of the north coast of Norfolk. The original physiographical work received a great impetus when V. J. Chapman began his ecological studies on Scolt Head Island.[10] In understanding saltmarsh formation the combined approach of an ecologist and a physiographer was found of much greater value than the work of either separately. Later work on the coastal peats, the animal ecology, and the sea birds has given us a unique knowledge of the island. Blakeney Point was studied similarly at an earlier date, but with less emphasis on the physical evolution. But to F. W. Oliver's early work[11] all coastal workers interested in saltmarshes owe a great deal.

Of wider interest is the liaison made from time to time between the Nature Conservancy and the Atomic Station at Harwell. The first phase, originating in my own department, involved the use of shingle made radioactive to trace sub-surface movements off the foreshore at Scolt Head Island.[12] This was followed by investigations on the movement of shingle at the south end of Orford Ness.[13] It is obvious that radio-active tracers and allied processes must play an increasingly important part in beach analysis, and the whole matter is under development at the Hydraulic Research Department at Wallingford. Since it is now possible to use material which is not injurious to health, the method will expand rapidly. The physiographer must once again work with specialists who are interested in similar problems but who may be viewing them, and working on them, from different points of view.

Allied to this is the direct observation of the movement of material on the sea floor by aqualungers. Work of this kind has already been carried out with marked success at Scripps Institute of Oceanography.[14] The lower temperatures of our own seas are no barrier to similar work here, in fact a beginning has already been made by the physiographical unit of the Nature Conservancy. The method has already been applied to the investigation of a submerged archaeological site. The training required is an integral part of the process, and it is not a task to be undertaken by the non-expert. Since, however, one of the vital problems concerning beaches is the possibility of their being fed from offshore material, the full development of aqualung and radio-active methods is of the utmost importance. Since it is now possible to make many more direct observations in fairly deep water, and to supplement them by tracer and other methods, the time has come for us to make a far more thorough study of the waters around our coasts. The nature and distribution of seafloor deposits and the analysis of former river courses and of other submerged features should throw a good deal of light on many of our studies which occasionally cease all too abruptly at sea-level.

Team work is not, of course, peculiar to Britain. Many instances could be cited from other countries. I will content myself with two. Niels Nielsen[15] of Copenhagen originated the long and fruitful series of coastal investigations on the Skalling peninsula of Denmark. The annual volumes of research papers that have appeared, except for the war years, show how the work has prospered, and how physiographers, ecologists, sedimentologists, and others have contributed to our understanding of the west coast of Denmark.

One of the best instances of collective work, involving a great deal of physiography, in elucidating an area is that of the Coastal Studies Institute of the University of Louisiana. Under the direction of R. J. Russell it has largely completed a masterly survey of the deltas of the Mississippi. The problems are geological, sedimentological, and ecological, and emphatically physiographical. Throughout all the engineering aspect is of the highest significance. The delta is in a subsiding area, and the various terraces of the river slope downwards towards the sea. A proper understanding of their sequence and formation can only be obtained by a sub-surface as well as by a surface exploration. The cheniers, sand and shell ridges formed by wave action, are an integral part of the delta, and the recent movements of sea-level, basically connected with the waxing and waning of the Quaternary ice-sheets, demand great attention in their effects on the growth of the delta. To some extent more recent vertical movement can be measured with reference to shell mounds, middens, left by the Indians. There is no need to emphasize the ecological and shore problems, but the advance and retreat of various parts of the delta, the quite anomalous bird's-foot delta of the Balize, the absence of the topset, foreset, and bottomset beds, the modern exploitation of the delta for oil and agricultural purposes, and the maintenance of shipping channels clearly imply the work of specialists in many branches of science. The effect of hurricanes on the topography of the delta is an interesting addition to the other investigations. Hurricane Audrey, in 1957, added some extensive mud deposits to the outer shoreline in the western part of the delta, and caused considerable damage to both natural and man-made features elsewhere.[16]

A related but slightly different tendency, and one of great value, has been the collaboration in recent years of physiographers with workers in very different branches of knowledge. As an example I will refer to W. V. Lewis's work on glaciers in Norway and Switzerland. He himself has published some interesting papers, and has co-ordinated the work of others, but I think a major contribution on his part is that he interested physicists and others in the process of glacier movement, and took them into the field with him. The work on the Austerdalsbrae has involved two university lecturers in physics and one expert from the Building Research Station at Watford.[17]

The physiographer is concerned with the features produced by glaciation, and with the ways in which they are formed. But workers have often assumed, rather than proved, that a glacier acts in a certain manner. The actual movement of a glacier is a complex problem, and one that falls particularly to the physicist. It is another example of the necessity of joint study if we are to tackle our difficulties properly. Here again the physiographer, because of his interest in land forms, may be the first to pose the problem; it by no means follows that, unless he has had a special training, he can solve it.

My own experience, especially in recent years, has emphasized the value of wide collaboration. In three fairly recent meetings, all in America, it was my lot to be the only geographer attending two of them, and the sole British geographer present at the other. All three meetings were concerned with various matters involving the coast—waves and coastal processes in general, saltmarshes, and coastal geography *sensu lato*. The point I wish to make is that many purely physiographical questions arose and were discussed, but by people who were by no means necessarily trained either as geologists or geographers. Many and valuable attitudes were revealed, and as a geographer largely concerned with physiography, I was only too often left far behind in discussions involving, for example, a mathematical or technical engineering approach.* I make no claim whatever that I, in my turn, contributed much to the several conferences, but one point struck me very forcibly in each of them—how very differently from his colleagues in other disciplines the physiographer who has sprung from a geographical training *may* look at the matters under discussion. A geographer is concerned with distributions, and a physiographical geographer should, in my view, not only know something of the particular problem on which he is working, but should also have as wide a knowledge as possible of areas, or districts, which offer related topics so that he may be able to make mental comparisons. This involves travel, and I am convinced that physiographers should travel, and observe intelligently, as much as possible. Only in this way can a reasonable perspective be obtained. Let me add that, although it is very often eminently desirable, it is not always necessary for the purpose I have in mind to travel extensively abroad.

We are particularly fortunate in Britain because we have representatives of so many rock types and stratigraphical divisions. Consequently we can appreciate the way in which, for example, limestone differs from sandstone or from granite in its topographical expression. Because of the often intensive work carried out in many parts of Britain, we may

* "To delegate to the civil engineer all fundamental research on geomorphic processes and forms has certain disadvantages. With his attention focused upon problems dealing with man-imposed modifications of the natural landscape, the engineer may have neither the time nor the inclination to investigate a broad range of natural phenomena where they are best displayed . . ." (A. N. Strahler, "Dynamic basis of geomorphology", *Bull. Geol. Soc. Amer.*, vol. 63, 1952, p. 924.)

have the chance of comparing the views of different writers on the landscape of a given region. But our islands are small. They are for the most part well-covered by vegetation, and in the south at any rate the landscape is largely man-made. We lack the wide open spaces and also the great ranges of climate to which they are often subject. There is nothing here to remind one of the tropical deserts, the steppes, and the prairies. Sometimes we are also apt to assume all too easily that what we see at home is typical of that elsewhere. One of the commonest features of our coasts is the shingle beach. Around the three long coastlines of the United States shingle is relatively uncommon, and pure sand beaches prevail.

Nevertheless the student of land forms can often be satisfied that Britain affords sufficient scope for his work. To take two very simple examples: anyone studying escarpments will find a great variety both as to form and origin, and also in relation to the rocks in which they occur. An investigation of cirques can be carried out satisfactorily in such diverse localities as Snowdonia, the Fannich mountains, and the gabbro of the Cuillins.

A major topic of discussion and active work in recent decades has been that to which Wooldridge gave the title of Upland Plains.[18] He himself has made a great personal contribution to the study, and has inspired many others to do so also. It is far from being a purely British problem. Baulig's work in France, the several reports of the Commission on Pliocene and Pleistocene Terraces of the International Geographical Union, to say nothing of the numerous papers from almost all countries testify to the interest it aroused. It is a matter intimately related to that of raised beaches and submerged forests, possibly even to submarine canyons. In the opposite direction Lester King[19] and others have applied it to far more extensive areas in their investigations of the history of South America and Africa. Hollingworth[20] has attempted a statistical approach to some of the surfaces in this country. Here we have a gigantic problem attacked by both geologists and geographers.

That the topic has in it much that may be the key to our understanding of the history of the surface features of the earth cannot be gainsaid. Despite, however, all the work so far accomplished there must remain many doubts, partly because so much of the earth's surface is inadequately mapped, partly because so much of it is little known in any detail. There still is uncertainty in many places about the origin of upland surfaces—are they marine or sub-aerial? Moreover, detailed work in certain localities occasionally seems to add to the number of platform remnants in a somewhat embarrassing manner.

A study of upland plains, often surfaces extending over vast areas, brings the investigator sooner or later up against the difficulty of how the surfaces, which may be stepped and separated by relatively abrupt

slopes, can stand at their present levels. It may be that the sea has fallen in stages, or the land may have risen locally. The answers to these questions are often completely outside the limits of physiography as ordinarily understood. They may well involve not only a study of climatic changes associated with the ice age and fluctuations of sea-level, but also the structural geologist, the geophysicist, and the nature of the earth's interior. The physiographical contribution to the problem of upland plains is of the first importance, but apart from the analysis of these features in as yet unexamined regions, one may ask if this subject may not have been taken to near its limit as far as physiography is concerned. It may well remain one in which there seems to be great scope for workers in other branches of science.

We come back once more to our definitions, and the first of the two given by Webster is relevant in this context. Rather more than a quarter of a century ago I had the temerity to write a book partly based on this definition. I should not do so again because, although I do not dispute the definition, I very much doubt if a physiographer is capable, except at second hand, of dealing with the origin of continents and oceans. His work may have some bearing on the subject, and he may well wish to use the conclusions of geophysicists, but the subject is uusally out of his province. If the physiographer is to make a contribution of value it must be based on his own original work.

A few years ago the application of statistical and numerical methods to the interpretation of landscape was revived and extended. We have long been familiar with the hypsographic curve and its possibilities, and we may remember the early attempts, especially of the Germans, to find, as it were, a formula to express a definition of different types of coast. These attempts involved much patient measurement on maps. It is fairly easy to measure the length of the salt-water coast of Norway and, in principle, relate it to a "simplified" coast. This may be a line joining the outer headlands, or one perhaps drawn through the upper parts of the fiords. The relation between the actual and simplified measurements could then be expressed as a fraction. If similar measurements were made of other fiord coasts it was hoped that there might be found a constant relation between the actual and simplified coasts. The same argument could be, and was, applied to rias and other coastal types. No common fraction was found in those measured, and even if it had been it would have been difficult to say what, if anything, it signified.

The modern techniques of analysing rivers, slopes, forms of drumlins, and other phenomena are very different, and some interesting ratios have been found. But it may be asked, how far do these techniques and measurements help us in understanding the land forms analysed? There is no doubt that the careful analysis made of selected areas has greatly advanced our knowledge of them and, what is more, directed

our attention to many of the problems they pose. In this way attention is focused on some of the problems we want to know more about. We have not, however, explained the origin of the land forms or features. That we may represent, for example, the order, number, and length of streams in given regions as straight lines or curves on some form of graph paper, and that we may find an index between climate and vegetation or some other pair of phenomena may well be an advance in technique, and may lead to further valuable work; but it is not in itself an explanation. Moreover, for many problems these statistical approaches are likely to emphasize map work at the expense of field work, unless the investigator has abundant time, facilities, or helpers. Map work of this sort may lead to many important suggestions, but it does not replace field work. It cannot be too strongly emphasized that the true basis of physiography is the field, and that other means of approach to field problems, however valuable they may be, are secondary. I fully appreciate, however, that in many cases a map investigation is a necessary prelude to field work, and that although morphometry of any land form is not an end in itself, it may be an essential step in the full explanation of it.*

At the present probably more time and more emphasis is given to the teaching of physiography in departments of geography than in those of geology. Geographers owe this very largely to some earlier heads of their departments, several of whom were trained as geologists. But all students of geography, whether specialists in physiography or not, benefit by a general training in that subject. It directs attention to the ground and on the make-up of the terrain in a way which is basic to all geography. As a specialist training it appeals to a considerable number of students, and demands a reasonable background of geology. It is, however, noteworthy that a great deal of physiography is not so much dependent upon a knowledge of geology as upon a careful observation and analysis of processes—and it is this aspect that I think is of fundamental value in teaching. It is not easy to measure all that is required to establish the régime of a river, the effects of waves and currents in relation to the formation of beaches, the deposition rates in estuaries and saltmarshes, or the precise movements of a glacier on the surface as well as in depth. The measurement of slopes and an analysis of the ways in which they retreat is all important, and presents very serious problems. There is no need here to enter into the general controversy, but only to insist on the necessity for, and actual difficulties of, slope measurement in the field. Such matters all involve careful scientific

* R. J. Russell, in the address to which I have already referred, says that geographers may find difficulty in obtaining any useful information from the conclusions of a pure morphologist, who may be much concerned with questions of structure, process, and time. The geographer, on the other hand, may well want more particular information "along the lines of what, where, and how much?" It may well happen that what is sometimes called nowadays quantitative geomorphology (or physiography) may give this kind of information as a by-product.

observation and deduction, and an increasing knowledge of the feature analysed.

Many of the problems with which the physiographer is concerned imply that he should be able to turn more and more to the laboratory where in wave tanks and other apparatus he should have facilities for some experimental work. The time has long since passed when the physiographer was able to remain content with general conclusions. How far the laboratory is a necessary adjunct to the physiographer depends very much on his temperament and his problem. Many will follow G. K. Gilbert who "seldom supplemented (field observation) by the collection of specimens and rarely extended (them) by work in laboratories or museums".[21] Others will seek to explore their problems with the help of wave tanks, stream channels, wind tunnels, and other means. That the use and significance of these aids to research and teaching should be demonstrated to the student is fundamental. It does not follow that all research workers on, for example, coastal problems need a wave tank to help solve their difficulties. But it may well mean that far more use should be made of this type of apparatus than is the case at present. No geographical department can afford to be without its cartographic laboratory. In the future, physiographers will require greater and more expensive facilities if they are to make the contribution which is in their power.

Wide reading, field excursions, personal field work are all vital in the training of a physiographer. Sooner or later, however, he will, be he young or old, have to seek the help of colleagues in other disciplines. But this seeking of help is not only a one-way traffic. The physiographer by the very nature of his subject has often to take a wide view and set his problem in perspective. He can, or should be able to, appreciate the factors that control his problem; it does not follow that he can adequately deal with all of them himself. He may well find that his work demands a knowledge of chemistry or biology that only a specialist can be expected to possess. He may have to seek expert help; he may have to study the subject himself. But the fact that he may more often have to seek help than to give it is not a weakness but an indication of the width and difficulty of his subject. Physiography, like its parent geography, so often has to be a synthesis. That is its charm as well as a difficulty, and a reason why team-work is often preferable in dealing with an area.

I do not wish to give the impression that team-work or a joint approach is always required, or that it is always best. This is certainly not the case. There are many subjects best attacked either as a whole, or in their preliminary stages, by a single worker. Nevertheless, I suggest that the general advance of knowledge is making it more and more worth while to consider a joint approach or some sort of team-work as the best means of attacking a job. But team-work can, and usually should, mean that the individual worker in a team is free to

develop his own share and derive full credit for what he has done. He himself benefits very much by the close collaboration with experts in other fields.

I have spoken of physiography in general, and not at any particular level. But that team-work is interesting people at all levels is shown in many ways. A glance through the annual reports of the Field Studies Council is revealing and shows how valuable is the training received, and the work done, by students either from universities or schools at the various centres. Both before and since the war many of our universities have sent out parties on long vacation expeditions. The standard of these varies a good deal, but with the increasing care and selection that is now being made both at the university, and later by the relevant committee of the Royal Geographical Society, the level reached is often very high. It is characteristic of many of these expeditions that they are organized and led by a geographer, and almost all involve physiography to a marked degree. Another, and most welcome, example of team-work involving geographers is undertaken by some schools. I have come across interesting reports and compilations by representatives of Bishop's Stortford and of Ampleforth, and these are but two of many. There is one other point: to be a successful worker and collaborator clearly means that any individual should have carried out personal research and have had field experience in which he has come up against, and realizes, the difficulties that beset him. His temperament may be such that he will never fit properly into any team—and I do not wish it to be thought that I suppose team-work to be the only way of advancing our knowledge of physiography. I fully realize the enormous part to be played by the individual. But the complexity of nature is such that only too often a joint approach is the most satisfactory, especially since we nowadays so often deal with a district or region rather than a topic.

REFERENCES

[1] H. Louis, "The Davisian cycle of erosion and climatic geomorphology", *Proc. of I.G.U. Regional Conference in Japan* 1957, Tokyo, 1959, p. 164.

[2] From the Foreword, *Survey of Barkly Region* 1947–48, Land Research Series No. 3, C.S.I.R.O., Australia, Melbourne, 1954.

[3] "La Géographie Française au Milieu du xx[e] Siècle", *L'Information Géographique*, Paris, 1957.

[4] R. J. Russell, "Geographical geomorphology", *Annals of the Assoc. of American Geographers*, vol. 39, 1949, pp. 1–11.

[5] H. Valentin, *Die Küsten der Erde*, Gotha, 1952.

[6] J. T. McGill, "Coastal classification maps. A review", *Second Coastal Geography Conference*, Coastal Studies Institute, Louisiana State University, 1959.

[7] G. K. Gilbert, *The Henry Mountains*, U.S. Geographical and Geological Survey of the Rocky Mountain Region, Washington, 1880; and *Lake Bonneville*, U.S. Geological Survey Monographs, vol. I, Washington, 1890.

[8] F. E. Matthes, *Geologic History of the Yosemite Valley*, U.S. Geological Survey, Professional Paper No. 160, Washington, 1930.

[9] S. W. Wooldridge and D. L. Linton, *Structure, Surface and Drainage in South-east England*, London, 1955.

[10] J. A. Steers (ed.), *Scolt Head Island*, 2nd edition, Cambridge, 1960.

[11] A. E. Carey and F. W. Oliver, *Tidal Lands*, Glasgow, 1918.

[12] J. A. Steers and D. B. Smith, "Detection of movement of pebbles on the sea floor by radioactive methods", *Geographical Journal*, vol. cxxii, 1956, p. 343.

[13] C. Kidson, A. P. Carr, and D. B. Smith, "Further experiments using radio-active methods to detect the movement of shingle over the sea bed and alongshore", *Geographical Journal*, vol. cxxiv, 1958, p. 210.
[14] D. L. Inman and T. K. Chamberlain, "Tracing beach sand movement with irradiated quartz", *Journal of Geophysical Research*, vol. 64, January 1959, pp. 41–47.
[15] N. Nielsen (ed.), Meddelelser fra Skalling-Laboratoriet, published in Copenhagen.
[16] *Second Coastal Geography Conference*, Coastal Studies Institute, Louisiana State University, 1959.
[17] W. V. Lewis and others, "Glacial investigation in Norway", *Royal Geographical Society Research Series*, No. 4, 1960.
[18] S. W. Wooldridge, "The upland plains of Britain: their origin and geographical significance", *Advancement of Science*, vol. vii, 1950, pp. 162–75.
[19] L. C. King, "A geomorphological comparison between eastern Brazil and Africa (central and southern)", *Quarterly Journal Geological Society*, vol. 112, 1956, p. 445.
[20] S. F. Hollingworth, "The recognition and correlation of high-level erosion surfaces in Britain: a statistical study", *Quarterly Journal Geological Society*, vol. 94, 1938, pp. 55–84.
[21] R. A. Daly, "Biographical memoir of William Morris Davis, 1850–1934", *National Academy of Sciences of the United States of America Biographical Memoirs*, vol. xxiii, eleventh memoir, Washington, 1945, pp. 263–303.

# On the Human Geography of the Nile Basin

J. H. G. LEBON

THE NILE IS ONE OF THE GREATEST RIVERS of Africa and the World. The remotest headwaters—the Victoria Nile, which joins the Albert Nile to form the Bahr-el-Jebel or Mountain River—rise on the East African Plateau, in one of the most picturesque and beautiful parts of Africa. The great rift valleys, their bordering escarpments, upheaved and dissected block mountains, extinct volcanoes, rolling downlands, serene lakes and foaming waterfalls all impart a grandeur and a diversity which is often lacking in this continent. Of not less impressive appearance and decidedly greater ruggedness and altitude is the Ethiopian massif, giving birth to the Blue Nile, Sobat and Atbara rivers, which cascade westwards through profound defiles. The Bahr-el-Jebel, Sobat and Blue Nile all traverse, and eventually mingle their waters within, the great pear-shaped Clay Plain of Sudan, developed on a large down-warped basin. Until late in the Pleistocene, this depression may have been a fairly shallow lake. Now it is a clay surface of extreme uniformity and flatness. It is interrupted only towards the north, where inselbergs appear, not quite buried in the sediment. Yet farther to the north, beyond Khartoum, gravelly and rocky plateaus alternate with clay, and gradually the desert supervenes. Dunes become more frequent, rock outcrops, gravel expanses, inselbergs and mesas become more numerous until the Libyan and Nubian deserts proper are reached at about lat. 18° or 19° N. In the former desert, sand predominates; in the latter, bare rock and mountain. The main Nile, by a hydrological miracle, winds its serpentine way within an incised valley, bordered in some reaches by narrow flood-plain terraces, but elsewhere yet more confined in the intricate rocky gorges of the famous cataracts, until at Aswan it enters Upper Egypt whence a wider flood-plain continues to the delta.[1]

The desert-engendering perpetual drought north of lat. 20° also attenuates the Nile system. The last confluence of a tributary—of the Atbara river—is at lat. 18° N. Northwards are but valleys in which water flows only at intervals of years. South of this critical latitude, rain falls annually: not in abundance in north-central Sudan, but sufficient to produce sudden, sometimes violent, floods in most years in many seasonal watercourses. Indeed, between lat. 20° and lat. 6° N

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the tropical continental climate manifests its normal gradation. The rainy season lengthens from one to ten months and the annual average rainfall from less than one inch to about 60 inches. Of greatest significance is the clear-cut division of the year into two seasons, one rainy, the other dry; and the drought is not relative, but absolute, for rain does not fall, even in the smallest amounts, during the months when the northeast Trade Wind is blowing. It does not matter whether the rainy season lasts one month or ten. The complete contrast between the two seasons compels all vegetation to be tropophilous, whether of short grass and acacia scrub in the north, or close-growing tall grass and semi-deciduous woodland in the south.[2] Throughout this entire zone, some 850 miles from north to south, the period of growth, verdure and blossom alternates with drought, leaf-fall, withering and yellowing (Fig. 1).

Beyond this zone, on the lake plateau, is an equatorial rainfall régime, and no months are without rainfall. But the annual average is often below 60 inches, and exceeds 80 inches only on mountains. Moreover in the months of lesser rainfall, at and after the solstices, there may be water deficit. Here tropical rain forest is rare and savanna, both of short and long grass types, is more prevalent.

### RIVER AND POPULATION

A population of perhaps 45 millions lives within the watersheds of the Nile system, almost wholly dependent on cultivation and the keeping of domestic animals. But the economies of the peoples living in the highlands and plateaus where the main river and its chief tributaries rise—i.e. in Ethiopia, Uganda and the Ironstone Plateau of Sudan—differ from those of the Sudan plains and Egypt in respect of the use made of the river system itself. The former in general make only *incidental* demands upon the waters of the Nile. Domestic water may be drawn; and there is some fishing both in rivers and lakes. But crops and the fodder plants needed by animals depend upon rainfall, not upon irrigation. Settlement is widely dispersed, and even avoids valley-bottoms and lake-shores, where marshes or deep gorges occur. Only small groups, e.g. the fisher-folk of the islands of lake Victoria, derive their livelihood from the water.

Thus the Baganda are dispersed, fairly densely, over the region just to the north of lake Victoria. Avoiding marshy and forested valley-bottoms, their farms are dotted over the intermediate slopes of a dissected plateau, where permanent plots of bananas and coffee are maintained, and crops of cotton, beans, ground nuts and sweet potatoes are grown in alternation with bush fallow.[3] Again, in southwest Sudan, close to the Belgian Congo frontier, Azande homesteads are scattered, though more sparsely, on the northern fringe of the rain forest. In small clearings, selected after observing plant indicators of fertility, finger millet, cassava, some cotton and vegetables are grown. After

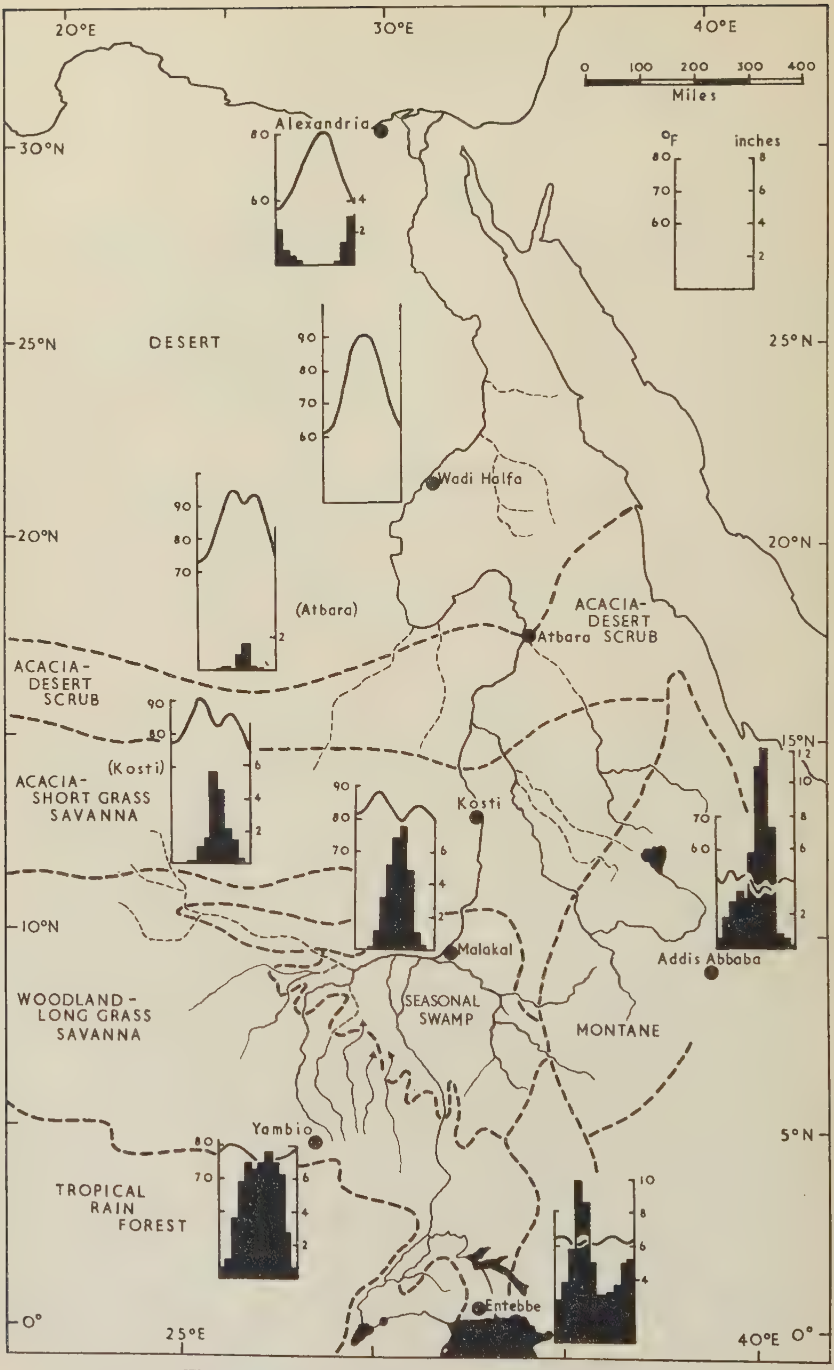


Fig. 1.—The Nile basin: climate and vegetation.

harvest, from January to March, fish are caught in the pools of main rivers, diminished in volume by the cessation of rain. Hunting is also

an activity at this season. After from 6 to 15 years, their homesteads are abandoned and new settlements made at distances varying from about half a mile to a few miles. They are, therefore, shifting cultivators.[4]

But away from the Ethiopian mountains and the lake plateau, the rivers themselves are *essential*, and not incidental, to the lives of Sudanese and Egyptians. On the Clay Plain, as far as lat. 12° N, the main rivers are vital to the lives of cattle-owning tribes in the dry season, though not in the rainy season. Farther north still, as rainfall lessens, and the dry season lengthens, the waters of the river are yet more indispensable to man and population distribution becomes more riverine. North of Khartoum, the dependence on the river becomes absolute. Settlement is restricted to a ribbon of land within sight of the channel; within a stone's throw of the banks, or at most a few miles, are the wastes of the Libyan and Nubian Deserts.

### THE NILOTIC PASTORAL TRIBES

The Clay Plain of Sudan, between lat. 6° and lat. 10° N is subject to a peculiar hydrological régime, which profoundly influences the economy of the inhabitants.[5] The surface is so level as to lack normal drainage. The rain, when it falls, cannot run off. The rivers, both from Ethiopia and the Nile–Congo divide, overflow because their longitudinal profile gradients are insufficient to discharge the increased volume of water. During the rainy season, therefore, the Plain almost in its entirety, becomes a vast swamp, and is impassable. Communication ceases, except by boat along the main rivers. But in the dry season, the standing water evaporates, and in the early months of the year, after being swept by grass fires, the region becomes a blackened waste. It was on 1st December 1870, after an unusually short rainy season, that the explorer Schweinfurth, then at Ghatta's zeriba, at the south-western edge of the Plain, lost his journals, collections and stores by fire.[6] The hazard to villages and to the traveller remains today, though administrative posts are protected by fire-lines and enforcement of regulations stipulating that huts must be adequately spaced. In the dry season, there is water only in the main rivers and certain adjoining areas of permanent swamp, dominated by the tall reed-like papyrus (*Cyperus papyrus*). Because masses of floating vegetation may block navigable channels, these swamps have been called the *sudd*, from the Arabic word meaning barrier. Their extent has been over-estimated by travellers who have crossed the Plain by boat and have been over-impressed by the continuous walls of papyrus which along the Bahr-el-Jebel extend from Bor to the Sobat confluence, i.e. about 385 miles. An anecdote which has been preserved from a steamer journey by Lord Cromer, then Resident-General in Egypt, in the early years of this century, illustrates this fact. Lady Cromer's English maid found scenery composed entirely of papyrus reed unbearably monotonous. On the third or fourth day, she protested to her mistress: "Madam,

how long shall we be tarrying in this shrubbery?" Within the last ten years, the greater part of the Plain has been photographed from the air; and the papyrus swamps have been shown to extend at most about eight miles from the permanent channels. Beyond, the alternation between superabundance of water in the rainy season and absence in the dry season prevails. It is seasonal, not perennial, swamp.

As a consequence both of clay soil and grass fires, forest is lacking, though scattered trees and occasional thickets are not infrequent. But the continuous shade and high humidity demanded by the tse-tse fly is wanting, and cattle can be reared. The Nilotic tribes inhabiting this region, numbering 1,850,000 or 18 per cent of the population of Sudan (1955–6), are cattle-owners who have adapted their mode of living most remarkably to the unusual characteristics of their homeland. As the rainy season progresses, in May and June, frequent heavy rains and overflowing rivers cause water to spread far and wide. Men therefore retreat, with their beasts, to areas above the flood. In the heart of the Plain there is little of such higher land; in fact it exists as mere islets between the Nile and its chief tributaries, upon which crowd the Nuer and eastern Dinka, with their cattle. But around the western margin there is more unflooded land suitable for rainy season occupation, along the edges of the Ironstone Plateau (owing its name to the lateritic deposits and soils covering the Archaean rocks of the exposed Basement Complex), and on the left bank of the Bahr-el-Ghazal. Here, at this season, dwell the majority of the western Dinka, numbering about 850,000. Unflooded land is also to be found close to the White Nile below the Sobat confluence, occupied on the left bank by the Shilluk and on the right by northern Dinka (Fig. 2).

What are regarded as the permanent villages stand in these tracts above the flood. Huts are often built on piles, so that the smoke from smouldering fires, kindled beneath, can permeate the interior and envelop the exterior, as an expedient to repel swarms of biting flies and mosquitoes. Ashes, smeared over the body, give additional protection. Thus conical thatched roofs are often to be glimpsed above the heads of tall millet (the common millet, *Sorghum vulgare*), which is the chief food crop; and women may be seen on balconies, scaring birds which, with other pests and diseases, often take a toll from the grain. The cattle graze near by, usually on land that is being rested from previous cultivation; but they do not thrive, because the available area is so small. At night, they are tethered beneath shelters, which are also fumigated constantly with wood smoke.

As the rains abate, in October and November, the floods diminish and the long grass which has grown through the standing water begins to dry. Some is fired, so that new growth from lingering moisture in the soil may be grazed before the vegetation becomes completely dormant. But cattle depend mainly upon types of grass growing in places which remain moist until late in the dry season (Dinka, *toich*), close to the

permanent swamps. Cattle and their herders therefore move slowly towards the rivers and swamps, and as the dry season advances again crowd into diminishing grazing areas. The distances traversed in the course of this migration vary from about ten to fifty miles. At convenient places not far from permanent rivers or backwaters, the dry-season cattle camps, sometimes visible from the navigable channels, are established.

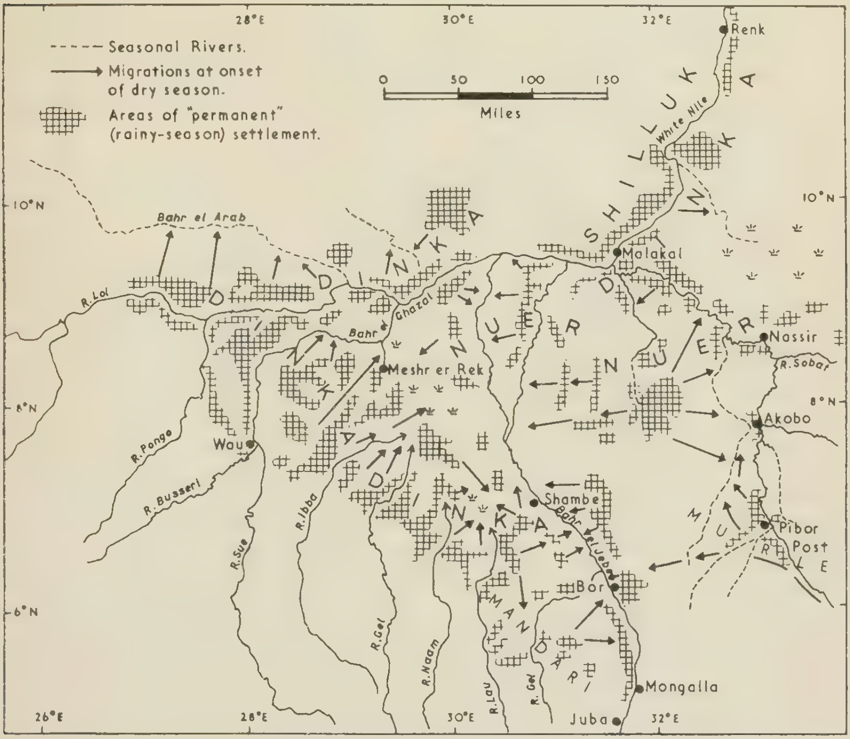


Fig. 2.—Seasonal migrations of pastoral tribes in southern Sudan. Reverse migration movements take place at the end of the dry season.

Fishing is an important additional source of food at this season. Fish may be speared from boats or caught in pools and shallows by groups of men, women and children working together. The cattle camps are occupied until April, and then, as the first showers heralding the next rainy season start new growth on the blackened plain, the slow return to the permanent villages is begun. Thus the cycle of the annual migration is completed, during which cattle alternate between privation (towards the end of both dry and wet seasons) and well-being (during the transitional seasons).

Only the Shilluk and northern Dinka, living close to the navigable White Nile, have begun to emerge from a subsistence economy and are selling small surpluses of cotton, millet, cattle and hides.

THE EAST CENTRAL RAINLANDS OF SUDAN

Between lat. 10° and 15° N, the northern Clay Plain receives insufficient water during the short rainy season, lasting from two to four months only, to become a seasonal swamp. West of the White Nile, through central Kordofan to Darfur, is completely different terrain, a great stretch of sand (Arabic, *Qoz*), once a southward extension of the Sahara and now fixed by the short grass and acacia scrub which is its natural vegetation. East–west movement is facilitated along this zone between the seasonal swamps to the south and the desert to the north. The pilgrim route from West Africa to Mecca passes this way. Adjoining the *Qoz* to the south is an area of Archaean rocks, diversified by inselbergs, large and small, and known, from the peoples living there, as the Nuba Mountains.

Millet, either the common millet best suited to clay lands or bulrush millet (*Pennisetum typhoideum*) on sand, is the most successful crop in this zone, which is often called the Central Rainlands of Sudan. Sesame and ground nuts also grow well. Sowing begins with the rains in July; growth is active (when showers are well spaced) during August and September and is completed from residual moisture in October and November. The rather variable harvest is in December.

But until the present century agriculture was subsidiary to pastoral activities. The mobility of the nomad was advantageous under an imperfect government which could not guarantee security. Water supplies also were too precarious in a land without permanent streams except the Nile, and native wells (though often deep, thanks to ingenious traditional methods of sinking and lining) yielded only small amounts of water and were liable to fail. Hollowed-out trunks of the *tebeldi* (baobab) tree, filled during the rainy season were, and still are, valuable reservoirs of water during the dry season but could not permit more than very small numbers to remain settled. As the annual drought advanced, the wholly nomadic peoples, and most cultivators, migrated with flocks and herds to the vicinity of the few reliable wells or to the Nile, Sobat or Bahr-el-Arab. The Nuba folk, perched amid their granite crags, relied upon wells and cisterns excavated in fissures in the decayed rock.

After the Condominium was established in 1899, permanent posts and improved communications were needed to make possible the pacification of a very unsettled country and to lay the foundations both of modern administration and the economic development which alone could provide revenue. The railway built to supply Kitchener's expedition was extended westwards to Sennar and El Obeid (1911), and a branch was built from Atbara to Port Sudan and Suakin (1905). Modern drilling equipment was introduced to sink deeper and more productive wells along the railway and at administrative centres. Donkey-engines were installed to pump water into the overhead tanks of "water yards". (To the Arab of northern Sudan, the English word

"donkey" means a small steam-engine, not an animal.) Water became available in excess of the needs of the railway and the small administrative centres. This encouraged people to settle permanently in villages as far as 10 miles from the new sources of water (using their camels and donkeys to carry water to their homes in leathern bottles), and to bring more land under cultivation. Flocks and herds could also be augmented.

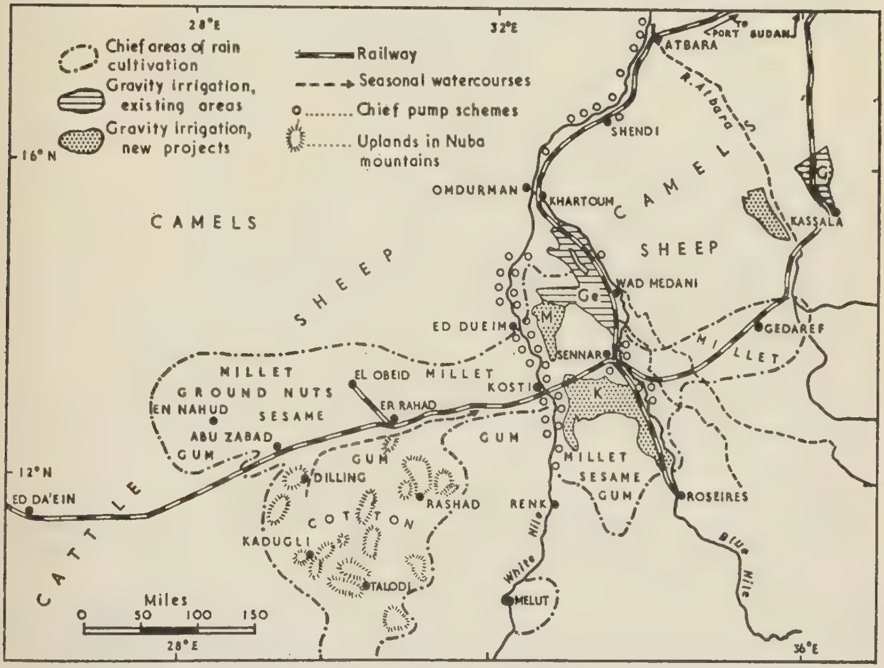


Fig. 3.—Eastern rainlands of Sudan—economic development. Irrigated areas: G—Gash Delta; Ge—Gezira; K—Kenana; M—Managil.

A further stage in economic advancement was attained in the 'thirties, when the Gezira irrigation scheme came into full production, and the Blue Nile became the basis of livelihood for a peasantry growing a cash crop—long-staple cotton—which in the course of years has also become the mainstay of Sudan's revenue.[7]

Yet another impulse to settlement and extension of agriculture was provided by intensive well-digging in the Nuba Mountains region, in the piedmont zones of the inselbergs and massifs (between 1935 and 1939), and by the post-war excavation of about 250 small surface reservoirs (*hawafir* or *hafirat*, sing. *hafir*), sited to impound run-off from watercourses and hillsides during rainfall. Many miles of new tracks were cut through acacia scrub in the course of these works. Areas adjacent to the Nuba Mountains (especially in the south), formerly largely unused, are now producing rain-grown cotton. In the Clay Plain south of the Gezira scheme, many new permanent villages have

been founded, and much gum arabic, millet, sesame and ground nuts is now produced for sale (Fig. 3).[8]

The Three Towns—Khartoum, Khartoum North and Omdurman—have profited by their nodality, and their population is now 246,000 (1955). Selected in 1824 as capital of a new dependency by the Egyptian conquerors of Sudan, the triple town has become the chief focus of communications in northern Sudan, thanks to the railway, the navigable Nile and to the capacity of the motor lorry to traverse semi-arid country on unmade tracks.[9] (Lorries from the Three Towns may operate as far as Dongola to the north, Kassala to the east, Malakal to the south and Nyala (Darfur) in the west.) Their urban growth has been accompanied by that of many smaller market towns along the rivers, railways and at crossings of motor tracks.

It is not fanciful to perceive in the northern Clay Plain, the Nuba Mountains and the eastern *Qoz* a region of increment, in which agriculture, and to some extent pastoralism, has been stimulated by the provision of new water supplies, communications and irrigation works (Fig. 3). Population has increased and at the same time become more sedentary and immigrants have been attracted not only from the land-hungry Nubians of the Northern Province but also from the west —the far west of West Africa—as a by-product of the pilgrim traffic.[10] It is not far-fetched to compare the hinterland of Khartoum with the Paris Basin or with Mesopotamia. It serves as the nuclear region of modern Sudan as the Paris Basin did for mediaeval France or Babylonia for the Abbasid empire. The economic progress of the last fifty years has been notable. Stable government, modern administration, a common language and religion (except in the Nuba Mountains) and the improvements in water supplies and transport already described have stimulated commerce, the profits of which have been invested by merchants or, after diversion into revenue, by the government, and have fostered nationalism.

## EGYPT

It is a truism that Egypt is the gift of the Nile. And the gift is the sole support of an entire country. Below the First Cataract, at Aswan, the flood-plain broadens in the wider valley excavated during several Pleistocene stages within a Pliocene gulf. Below Cairo, the flood plain expands into the delta. Without control works the 7 million acres at present cultivated in the valley and delta would be flooded annually, and, nearer the Mediterranean Sea, would be permanently marshy. In other words, the value of the gift has been realized only by much ingenuity and effort in water control.

The evolution of the present highly productive agriculture in a desert climate is familiar. The ancient system of basin irrigation produced but one crop a year—a winter grain—sown in October or November on land from which flood waters had receded, and harvested

in March and April. The barrages along the Nile, beginning with those erected at the head of the delta, just below Cairo, between 1861 and 1887, and continued at Assiut and Zifta (1902), Esna (1908), Nag Hammadi (1930) and Edfina (1951), enable a summer crop—cotton, rice or millet—to be grown by raising the level of the water when the discharge is low.

But these barrages can function only if water is stored. The Nile discharge varies from a minimum of 40 million cubic metres per day early in May to a maximum of 700 million in mid-September. From midwinter to midsummer the river is low and there would be little water to distribute when the summer crops are germinating, if it were not for the two great reservoirs at Aswan (completed in 1903, enlarged in 1912 and again in 1933) and at Jebel Auliya, just above Khartoum (completed in 1937). The first stores water from the falling flood in autumn after the silty main flood has passed to regenerate the soil of the country; the latter stores water from August (when the White Nile is already raised by the Blue Nile flood) until March, when the sluices are opened and the released water provides a useful addition to the declining reserve at Aswan.

Conversion of land commanded by the Nile from winter to all-year cropping has been extraordinarily successful. Long-staple cotton has become the most remunerative product in the Egyptian economy. Soil exhaustion has been prevented by artificial fertilizers, and water-logging by draining and pumping. Extensive marshes in the delta have been reclaimed and are sown mainly to rice. The population has increased from 9,700,000 in 1897 to 25 millions today. Till about 1907, the demand for labour exceeded the supply. The period from the abolition of the *corvée* in 1887 to about 1913 was a golden age for the Egyptian peasant. Thenceforward, the population growth exceeded increase of production. It has been estimated that one-third of the present population is surplus to the optimum. It is surprising that there should be so little emigration, but Egyptians are disinclined to settle away from the Nile.

### THE FUTURE OF THE NILE BASIN

A rational comprehensive view of the whole Nile basin should be the basis of planning for societies and communities dwelling therein, and exemplifies the value of human geography not only in school and university education but also in creating right-thinking public opinion. The Nile basin, until recently under British rule or dominance, is now a theatre in which the first act of the play of rivalry between actual and coming nationalisms has begun. Egyptians, aware that the source of their livelihood is now within the control of others, have evinced an almost neuropathic attitude towards the Nile waters problem. Sudanese are perplexed by the misunderstanding of and consequent delay in executing new schemes to strengthen their economy.[11] Both look with

anxiety to the southern watersheds where emerging African peoples are confidently expecting schemes to harness water resources for power production and perhaps also for irrigation.

In this situation, the two states at present most dependent upon the Nile have rejected plans, conceived under British influence, to develop further control upon purely hydrological and economic principles (which would require works mainly in Sudan, Ethiopia and Uganda) and agreed, in November, 1959, that new storage for national requirements should be provided on the soil of the beneficiary: for Egypt at Aswan (with compensation for the results of flooding the valley in Sudanese territory south of Wadi Halfa); for Sudan at Roseires, on the Blue Nile. This measure of agreement, after denunciation of the earlier Nile Waters Agreement (1929) by Sudan in 1955 and years of dispute, is welcome; but the price being paid for the sake of Egyptian policy and prestige is high, in terms both of money and of water loss through evaporation, for the alternative project, now indefinitely postponed, to eliminate losses in the swamps of the Bahr-el-Jebel by means of a canal to be dug between Bor and Malakal (the Jonglei scheme) would cost less and would increase water available to the two countries by at least an amount equivalent to evaporation from the enlarged Aswan reservoir.


REFERENCES

[1] The best general introductions to Nile lands are by H. E. Hurst, *The Nile*, London, 1952; and E. Ludwig, *The Nile* (2 vols.), London, 1937.

[2] J. D. Tothill (ed.), *Agriculture in the Sudan*, London, 1948, especially chapters 4 and 5.

[3] S. J. K. Baker, "Buganda, a geographical appraisal", *Trans. Inst. Brit. Geographers*, no. 22, 1956, pp. 171–9.

[4] P. de Schlippe, *Shifting Cultivation in Africa. The Zande System of Agriculture*, London, 1956.

[5] *The Equatorial Nile Project and its Effect on the Anglo-Egyptian Sudan*, Report of the Jonglei Investigation Team, 4 vols., Khartoum, 1955, especially vol. i and the maps in vol. iv, section E, 1–14.

[6] G. Schweinfurth, *The Heart of Africa*, 3rd edn., vol. II, London, 1878, p. 175.

[7] W. A. Hance, "The Gezira", *Geogr. Review*, vol. 44, 1954, pp. 253–70; H. R. J. Davies, "Irrigation developments in Sudan", *Geography*, vol. xliii, 1958, pp. 271–3.

[8] J. H. G. Lebon, "Rural water supplies and the development of economy in the Central Sudan", *Geografiska Annaler*, tome xxviii, 1956, pp. 78–101.

[9] J. H. G. Lebon, "Desert motor routes in Northern Sudan", *Geography*, vol. xl, 1955, pp. 271–3.

[10] The maps in 21 *Facts about the Sudanese*, Dept. of Statistics, Khartoum, 1958, and *The Population of Sudan*, Sudan Philosophical Society, Khartoum, 1958, are relevant.

[11] *The Nile Waters Problem*, Ministry of Irrigation, Khartoum, 1955; K. M. Barbour, "A new approach to the Nile Waters problem", *International Affairs*, vol. 33, 1957, pp. 319–30.

# Glacial Landforms in the Cader Idris Area

EDWARD WATSON

*During the Geographical Association's Spring Conference at Aberystwyth in* 1958, *the author led an excursion to the summit of Cader Idris, via Nant Cader and Cwm Cau, returning southwards along the watershed to the lower end of Tal y llyn Lake. This small area contains a superb collection of glacial features and shows very clearly the interaction of structure and process. It is therefore believed that a description of the area might be of interest not only to those who went on the excursion, but also to the many other geographers who from time to time climb to the summit.*

## STRUCTURE AND RELIEF

LYING on the southern flank of the Harlech Dome, the area consists of a series of Lower Ordovician volcanic rocks and mudstones dipping southeastwards.[1] As the section (Fig. 2) shows there is a close correlation between geological outcrop and the form of the ground. The great north-facing escarpment is formed mainly of a thick granophyre sill. Capping the sill and with it forming the summit ridge of the Cader Idris range are the Upper Basic Volcanics,* a very resistant series of basic lavas and ashes. Overlying these volcanic rocks are the dark fine Llyn Cau Mudstones, a weak belt which coincides with the axis of the west-facing cwm and of Cwm Cau. On Fig. 1 it will be seen that where, at its eastern end, the granophyre sill transgresses the Basic Volcanics and the Llyn Cau Mudstones into the base of the Upper Acid Volcanics, it closes Cwm Cau (cf. *cau*, to close) and that Nant Cader turns southwards flowing parallel to its margin. The Upper Acid Volcanics,* a further series of volcanic ashes and rhyolite flows, which overlie the Llyn Cau Mudstones, form the craggy ridge bounding Cwm Cau and its west-facing counterpart on the south. These are in turn overlain by another series of fine-grained mudstones —the Tal y llyn Mudstones—which extend to the southern limits of the area, forming generally lower ground with softer outlines than the volcanics. The dominating feature of the Tal y llyn Mudstone belt, however, is the great fault-line along which the deep narrow valley of the upper Dysynni has been excavated.

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* Since neither the Lower Basic Volcanic group nor the Lower Acid Volcanic group are involved in this discussion, it is proposed to use here the terms Basic Volcanics and Acid Volcanics for these rocks.

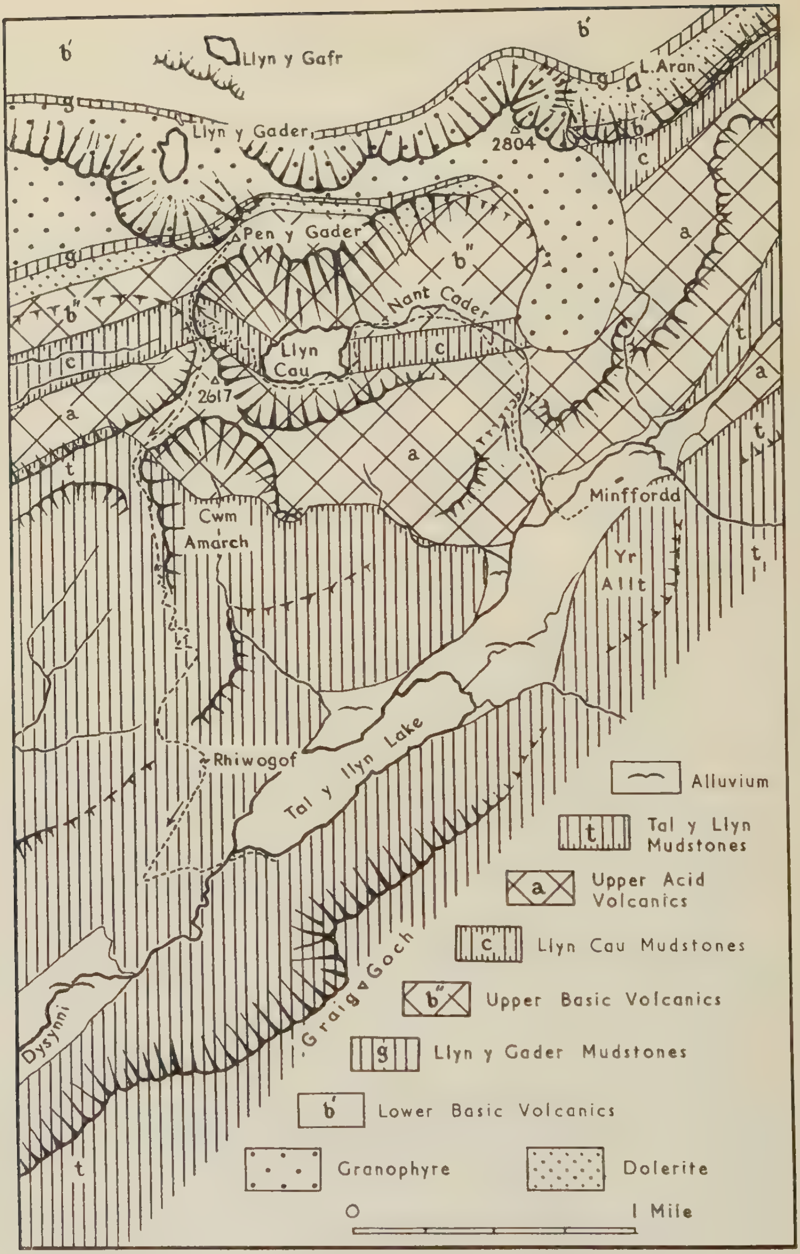


Fig. 1.—Geology o the Cader Idris Area, after A. H. Cox. The pecked line indicates the route described.

## THE RIVER PATTERN

Figure 3 shows the existing drainage pattern which has been interpreted[2] as the result of the rapid development of a pirate tributary of the lower Dysynni along the belt of shattered rock—the brecciated zone of the

Tal y llyn fault. The original drainage in the area would thus have consisted of two systems: one, the Dysynni with its tributaries, the Dol goch, the Gwernol and the Iago flowing northwest across the fault-line to the trunk (lower Dysynni–Afon Cader) stream; and the second, the Dovey into which the Nant Cader flowed, also across the fault line and via the Dulas. The watershed between the Dysynni and the Dovey systems then ran through Cader Idris and Graig Goch. This pattern was disrupted by the development of a lateral tributary of the Gwernol along the Tal y llyn fault, capturing the upper Iago and the head-waters of the Nant Rhiw'r Ogof leaving well-marked wind-gaps.[3]

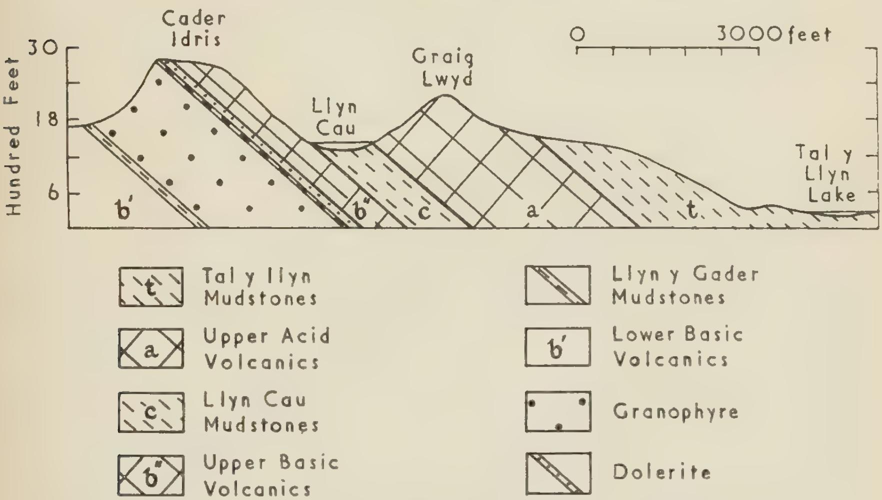


Fig. 2.—North–South section through the centre of Llyn Cau. The vertical scale is the same as the horizontal scale.

This pirate head has been further extended through the former Dysynni–Dovey watershed and now receives the Nant Cader leaving a wind-gap to the south, through which passes the road from Dolgelley and the north to Corris and Machynlleth. Whether this breaching of the watershed was accomplished by the ice—on the lines suggested by D. L. Linton for some of the valleys in the Scottish Highlands[4]—or achieved by the Dysynni itself pre-glacially, is a question requiring further study. As far as the area under consideration in the present paper is concerned the important point is that the straight trough following the fault-line cuts right across the general relief pattern. The highest ground flanking the trough is not at its head but on the former watershed as indicated on Fig. 3.

## THE MAJOR GLACIAL FEATURES

### *Cirques*

The most striking feature is the group of cirques centring on Bwlch Cau, the col southwest of Cader Idris summit (Pen y Gader). These show

very clearly the relation of cirque development to aspect and to structure. The best-developed cirques in our highlands face north and east. This is related to insolation by most authorities[5]—to the fact that glaciers would survive longest in these situations, just as snow does today, for steep north- and east-facing valley heads are in shadow for much of the year. (Members of the excursion had an opportunity of appreciating this in the field as they passed along the southern shore of Llyn Cau under the steep north-facing side-wall. Though it was a few minutes after noon in early April, the sun's rays were just parallel to the slope and a layer of clear ice crystals occurred between the thin mossy surface layer and the rock.) In the Cader Idris group magnificent cirques, with precipitous head-walls and lakes, face north and east, in contrast with the more poorly developed Cwm Amarch on the south. The valley head on the west, nameless on the O.S. maps (e.g. One-inch sheet no. 116, Dolgelly) but for convenience referred to here as the western cwm,* can hardly be said to have a developed cirque form at all. Significantly the only side of the western cwm exhibiting a cliff rim is that facing north.

In comparing the north-facing with the south-facing cirque it is clear that geological structure may have played a part in aiding the development of the former's sheer back-walls. The cirque is scalloped out of the structural north-facing escarpment and its steep walls have been formed by great joint-blocks, often measured in yards, being split from the sill. The south-facing cirque, on the other hand, is cut back into closely cleaved mudstones and acid volcanic rocks dipping towards the cirque, and it may be argued that neither of these would produce as precipitous a back wall. But in a comparison of the east- and west-facing valley heads the part played by aspect is quite clear. As they are both developed along the outcrop of the Llyn Cau Mudstones the same rock formations occur in each. Yet it is between Cwm Cau and the western cwm that the contrast is greatest.

The pattern of the morainic arcs in the cirques shows the same influence of aspect. The western cwm has none. Those in Cwm Llyn y Gader are symmetrically disposed across the lower end of the lake; normally the outlet for the lake is by seepage through the boulder moraine but in flood the lake spills out by a channel almost centrally situated in the morainic arc. In Cwm Cau the moraines are thickest and rise highest on the south side as if frost-work on the shadow-side had been contributing boulders from the cirque wall most rapidly there.

Arêtes are not a marked feature as recession of the head-walls has not proceeded far enough, the ridges between the cirques in most cases having considerable summit flats (cf. Fig. 2). The exception to this is Bwlch Cau at the northwest limit of Cwm Cau where rapid wasting on the mudstone outcrop has reduced the interfluve to a narrow asymmetrical ridge.

* Cwm in local usage has no glacial significance but is applied to any steep-sided valley whether of youthful V or cirque form.

*The trough*

The Tal y llyn valley is a fine glacial trough. It is straight, lacks spurs and has well-developed cliffs below the valley-shoulder, cliffs which fall away to the trough-floor in fine concave curves. The tributaries all hang above the main valley into which they descend by spectacular falls. The trough itself contains a lake which typically fills the valley floor from side to side.

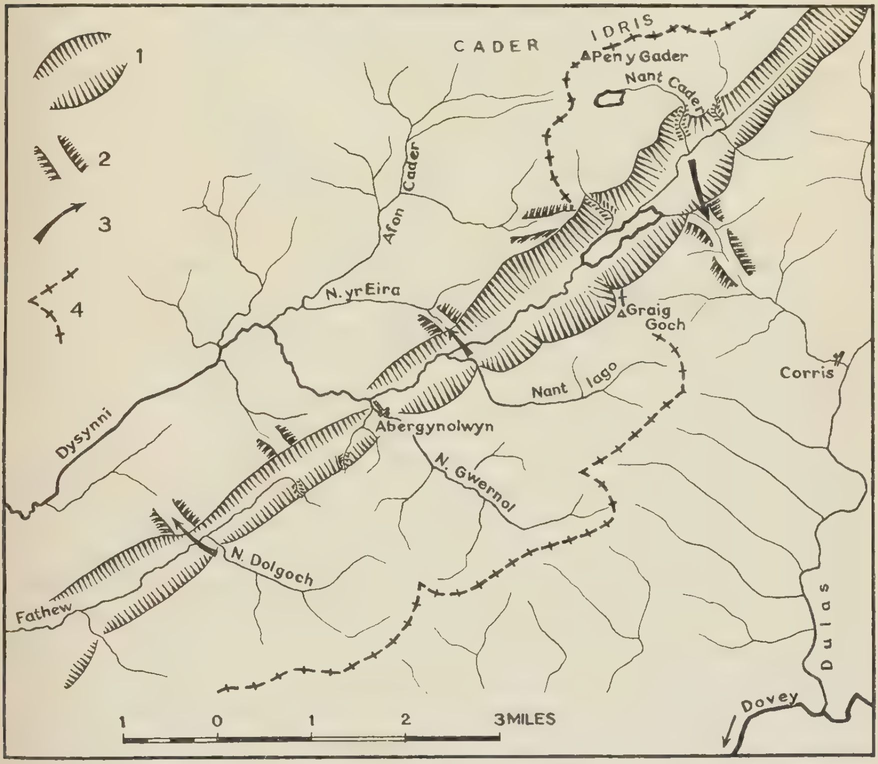


Fig. 3.—Evolution of the river Dysynni. 1. The fault-valley sides. 2. The wind gaps. 3. Suggested former direction of stream flow. 4. Former watershed between the Dysynni and Dovey basins.

The straightness of the main valley is partly a reflection of structure; it is developed along a fault-line. The importance of this is suggested by the fact that as a glacial trough it is without parallel in the district —indeed in the whole area south of Snowdonia. This is not to deny the existence of glacial erosion in the area (the existence of the valley lake in a rock basin affirms it) but to suggest that structure has conspired closely with it to produce this "text-book example" of a glacial trough.

*The valley lake*

Though it is enclosed on its lower shore by an undulating belt which rises some 80 feet above its surface, Tal y llyn Lake lies in a rock basin.

Numerous rock outcrops occur in the area below the lake especially on the southwest side (behind St. Mary's Church) and the recent widening of the road here has exposed shattered mudstones to a height of ten feet or more above lake level. Just below the lake outlet rock is exposed to a height of some 20 feet above the road on the north side. In steep banks such as those of the river, the rock appears to be shattered but there are enough exposures of solid rock to indicate that this is a *verrou* or rock bar that encloses the lake.

The position of the lake is of considerable interest in that it occurs in the hypothetical former watershed area between the Dysynni and Dovey basins. The ground on either side of the valley rises highest here so that ice flowing down the valley would be most constricted. This would lead to increased velocity of flow which would cause local over-deepening. Rock basins in glaciated valleys often occur upstream of a local valley constriction (e.g. the valley lakes of Snowdonia) but the constriction is frequently associated with a more resistant outcrop and the existence of the lake is therefore sometimes postulated as due to the more rapid erosion by ice of the softer beds. The significance of the Tal y llyn example lies in the fact that the valley is here entirely cut in the Tal y llyn Mudstones showing that it is the constriction of flow that is the important factor in these cases and not the existence of an outcrop of relatively weak beds.

The lake probably extended considerably upstream immediately after the retreat of the ice but the strongly hanging nature of the tributaries led to their bringing down large quantities of debris and depositing it in the main valley as cones. Tributaries coming off the volcanic rocks brought down coarse debris which forms relatively steep cones (e.g. the Nant Cader at Dol y Cae) but those from the closely cleaved mudstones have deposited slaty gravel in extensive flat cones which merge to cover most of the valley floor above the lake.

### *Weathering*

Structure has also influenced strongly the nature and products of late glacial and early post-glacial weathering. The steep rock faces below the shoulders of the cirques and trough were attacked by frost producing a mantle of scree on the lower slopes. On mudstones this consists of thin slaty fragments which as they slid on their flat sides down the slope developed a stratification or banding parallel to the slope. A cut at right angles to the slope thus gives a false appearance of horizontal bedding. Screes on the lower slopes of the mudstones are very thick; about 15 feet of a vertical face was exposed in a pit $\frac{3}{4}$ mile below Tal y llyn Lake (when examined in September 1951 but falls have since obscured the face). Similar thick scree occurs in several old pits, but fresh faces may be seen in the pits at the head of the pass on the Tal y llyn–Dolgelley road (Nat. Grid 756139) or even more imposing, the 25-ft face at Quarry Siding Halt on the Tal y llyn Railway (Nat.

Grid 654051). The fine concave sides of the trough are partly due to this mantle of scree and to the highly mobile nature of the smooth mudstone fragments forming the scree. These mudstone screes are now well covered with soil and form smooth slopes of grass and bracken, or of woodland. The screes below outcrops of volcanic rock, on the other hand, are coarse and bouldery and only partly covered by vegetation.

On the flat surfaces of the ridges and summits severe thaw-freeze produced *felsen meer* or block-fields on the coarsely jointed volcanics and these are still very apparent as they are only partially overgrown by moss and bilberry. On the mudstone summits the layer of small fragments rapidly developed a soil and vegetation cover so that no trace of the underlying rock is normally seen. Indeed the change from the outcrop of volcanic rocks to mudstones is often marked by a change from a dry bouldery terrain to wet peaty ground.

## THE EXCURSION ROUTE

Approaching the area from Aberystwyth and Machynlleth, a good impression of the concave sides of the Tal y llyn trough, and of the valley lake with its bar, the cone extending into it below Cwm Amarch and the rushy flats at its head, is obtained from the road (A487) on the south side of the valley by the bungalow (Nat. Grid 730105). Straight across the valley, the contrast between the vegetation-covered mudstone slopes and the rough craggy slopes of the Acid Volcanics is very marked, while the hanging nature of the Nant Cader from the lip of its upper valley is clear.

The path to Cader Idris leaves the Towyn–Dolgelley road (B4405), 300 yards southwest of its junction with the A487 and crosses the trough floor which is seen to be highest in its centre and to be falling gently away from the road towards each valley side; (hence the two parallel streams here, one on either side of the valley). The nature of the infilling—small slaty gravel—may be seen in road-side exposures (on the B4405) before the path is reached. To the right of the path as the edge of the steep wooded slope is approached, is the boulder-cone of the Nant Cader at Dol y cae, and as the ascent through the trees is made, the steep course of the Nant Cader with its gorges and frequent falls is seen at intervals. The top of this hanging section is reached at about 950 feet where the stream profile flattens out quite abruptly (1, Fig. 4). The view southwards from this point shows the wind-gap which formerly carried the Nant Cader to the Dovey. To the left, i.e. to northeast of the wind-gap is a fine faceted spur (Yr Allt).

The track passes the cottage ruin (2, Fig. 4) above the smooth boggy bottom of the Nant Cader valley. Ahead the high crags of the Basic Volcanics on the northern valley slope, with their fine screes, are coming into view and behind to the east is the dark smooth dome of Moelfryn. The latter is shown as composed of the Upper Acid Volcanic

Series on A. H. Cox's map, but recently it has been re-mapped by R. G. Davies[6] as the southern end of the granophyre sill. Its form and vegetation are markedly different from the Acid Volcanics on the southwest side of Nant Cader and the present course of the stream swings noticeably round its western margin. Three hundred yards beyond the ruin, the stream gradient steepens as it tumbles down over rapids in a shallow gorge. Rock outcrops on the south bank while on the north bank is a fine roche moutonnée on the Basic Volcanics

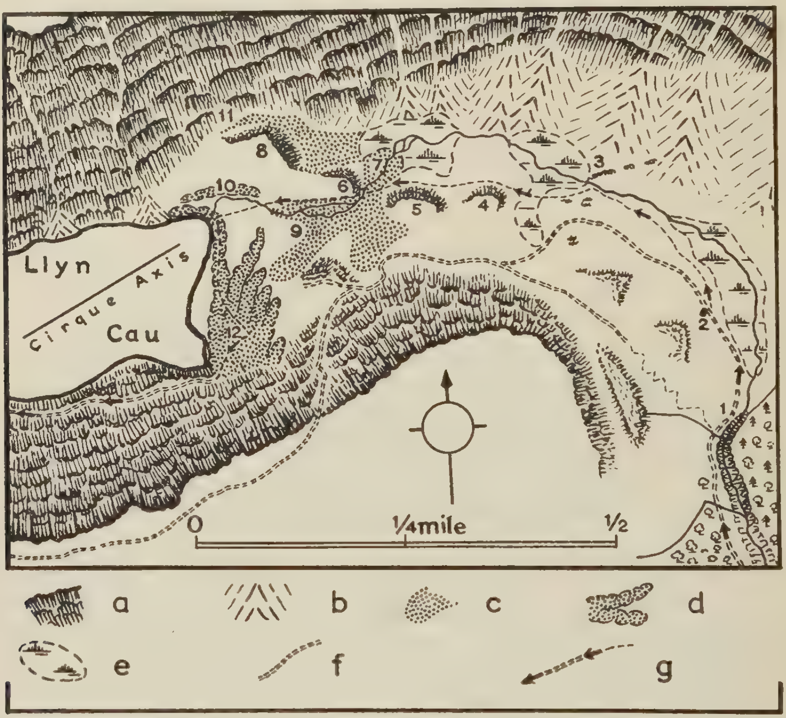


Fig. 4.—Cwm Cau. a. Rocky slopes; b. Scree talus; c. Boulder spreads; d. Boulder moraines; e. Boggy ground; f. Distinct tracks; g. Route. Numbers indicate references in the text.

(3, Fig. 4). The roche moutonnée has a steep downstream face but its upper surface is very gently inclined upstream. These outcrops on both banks form the lower edge of a flat boggy basin, which extends some 200 yards upstream. This is probably a shallow rock basin, now infilled with later stream deposits and vegetation, and represents a small-scale example of the familiar basin and step.

Continuing upstream, the route crosses a boggy hollow at right angles to the stream, which coincides with the line of a fault mapped by R. G. Davies. On the rise beyond, two elements stand out, separated by a craggy ice-moulded boss of Basic Volcanics (4, Fig. 4). On the north side the ground falls quickly to the basin occupied by the Nant Cader—on the south it gives way to a smoother surface mostly

vegetation-covered but showing smooth rounded outcrops of mudstone. Fig. 5 shows these relationships. The trough occupied by the stream is wholly on the Basic Volcanics and the bench on the south side mainly on the Llyn Cau Mudstones. Between the trough and the bench a series of craggy Basic Volcanic outcrops continue to the head of the trough (4, 5 and 6, Fig. 4). Thus the adjustment to structure occurring at Llyn Cau is not continued down the valley. It is, however, by no means unusual for streams whose valleys are developed on the weaker beds as in Cwm Cau, to flow locally on the more resistant underlying rocks of the dip slope. Adjustment to structure on steadily dipping beds involves a continued uniclinal shift as the beds are lowered and at any point of time the process of adjustment may be incomplete.

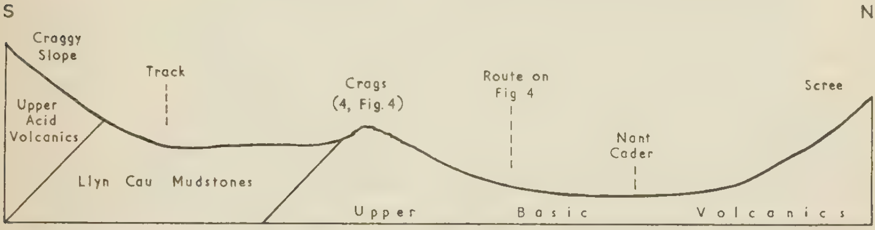


Fig. 5.—Cross-section of Cwm Cau, one-third mile below Llyn Cau.

To obtain an easier gradient, the established tracks ascend by the mudstone bench (passing to the south of the Basic Volcanic crags), but a much better impression of the glaciated character of the valley is got by keeping to the valley floor (as indicated on Fig. 4). The boggy basin referred to above is succeeded by a slight boulder-strewn rise. Above this is another boggy basin which ends against a steep craggy slope some 250–300 feet high—marking the drop from the cirque basin above (8, Fig. 4). Steps in glaciated valleys sometimes coincide with resistant outcrops which cross the valley but in this case the outcrops run parallel to the valley, the step and the basin below, both being of Basic Volcanics. Nor can the existence of the step be ascribed to confluence as only the cliff-rimmed Cwm Cau lies above it.

The Nant Cader does not, however, plunge down the face of this step but enters the basin by a fairly open gap at its southwest corner—a breach which occurs along another transverse fault.[7] This open valley is choked with large boulders over which the stream tumbles, the boulder spread extending out on to the flat boggy floor of the basin as a cone (7, Fig. 4). From the latter it can be seen that no less than three boulder-filled steeply-falling shallow depressions lead to the cone, and that only the one on the right contains a stream. As the ascent is made beside the stream a good view of the ice-moulding of the step (6 and 8, Fig. 4) with its rounded top and craggy downstream side is obtained. This contrasts with the vegetation-covered mudstone slope to south of the stream (9, Fig. 4). The gradient of the stream

flattens out again at the head of the boulder-filled section, where the bench or shelf on which the moraines stand is reached; the two other boulder-spreads also end at this level. On the bench, the stream flows across a boggy flat which stretches up to the moraine on the lake shore.

This moraine is small, about 10 feet high and completely cut through by Nant Cader. It is almost certain that rock underlies the bog in front of the moraine and that the lake, 163 feet deep, is in a rock basin.[8] From the moraine, the view of the cirque is most impressive and the relationship between structure and its form very striking. The shadowy, steep, craggy back-wall on the Acid Volcanics contrasts with the grassy section on the mudstones. The sky-line, craggy on the two volcanics series, is surprisingly smooth on the mudstones. The mudstone section of the back-wall has weathered more rapidly than the volcanic rocks on either side and has therefore a gentler slope; it thus offers a feasible route to the summit from which memorable views of the cirque and its back-wall are obtained. This route is best approached by the track on the south side of the lake.

Taking the moraine on the east shore of the lake as the inner arc, the southern wing of the second arc is seen across the boggy flat petering out at the edge of the bench on which the lake stands. On the north bank of the stream is a bouldery slope which may represent in part the northern wing of this arc (10, Fig. 4). The arc was probably never complete, owing to the sharp break in slope, and may be represented by the spread of boulders in the valley below.

Above the bouldery slope, north of the lake outlet, it will be seen that these boulders lie against a bench composed of the Basic Volcanics (10, Fig. 4). In this area, the cliff shading on the O.S. maps gives the impression that the cliffs on the north side of the cirque fall to this bouldery slope so that Llyn Cau appears to have an east-west axis. Actually, the lower part of the cliff-shaded area forms a rock bench and the foot of the cirque wall is set back to give the cirque an E.N.E.–W.S.W. axis (see Fig. 4). On the extreme northern edge of this bench, between it and the north wall, is a shallow V-valley intaking on the bench and filled with boulders (11, Fig. 4); these boulders may also have been washed out from the ice-front when it pressed high on this bench, though in part they may have come down from the steep cirque wall.

Crossing to the moraines on the south side of the cirque (12, Fig. 4), it will be seen that there is a high and thick accumulation consisting of several moundy ridges. These ridges consist of blocks largely covered by vegetation, and each of them dies out when followed north-north-eastwards, like the second arc. The total morainic accumulation on this southern side is very much greater than that on the north, suggesting that a large part of the blocks in the moraines was derived from frost-shattering on the north-facing cirque wall. It should perhaps be stressed that these moraines must date from a very late stage—probably a re-advance—in the history of the cirque.

Having skirted the south side of Llyn Cau and ascended the mudstone slope to the col, south of Pen y Gader, the most striking impression is the contrast between the western cwm and Cwm Cau. The former has a rough broken surface but is a shallow open valley-head compared with Cwm Cau which bites into the hill-side as abruptly as a quarry. Continuing up the slope towards the summit the outcrop of the Basic Volcanics is marked by a rough bouldery terrain—the late (?) glacial block-field. This covers the summit flat of the range, though its nature varies with the rock type. On the Basic Volcanics it is formed of coarse blocks which have therefore only a scanty vegetation of moss and bilberry, while on the granophyre which breaks down to smaller debris it carries an almost continuous dry turf of fescue and bilberry. From the northern slope edge, by the summit, a fine view of Llyn y Gader is obtained, with its moraines symmetrically arranged across its front, and its high-water outlet by the small kettle lake in the centre of the moraine. The sheer cirque walls drop to magnificent block screes except at the eastern limit where a rubble-slide, Fox's Path, forms a route northwards to Llyn Gwernan. This slide does not reflect a change in rock-type but is on the granophyre and its gentler declivity may be related to its westerly aspect. In this respect it may be compared with the sharp break bounding it on the east, which forms the rim of the next cirque-like embayment (also containing a moraine visible from the escarpment top).

The path to Tal y llyn valley passes along the head of the western cwm but if, before descending, the rim of Cwm Cau is followed to the summit of its back wall (unnamed on the O.S. maps, at 2,617 feet), the view shows very clearly the axis of Cwm Cau with the benches on either side of the lake outlet. From this point it may best be seen that the trough of Nant Cader below the lake bench is directly in line with the axis of the cirque—a fact not easily appreciated in the broken terrain at the step itself. The rim of Cwm Amarch is followed southwestward, giving good views of this cirque, which though better developed than the western cwm, yet is much inferior to those containing Llyn Cau and Llyn y Gader. The change in the back wall from the Acid Volcanics to the mudstones is marked by a surface change from a rough craggy slope with boulder patches to a sharply defined rim with the slope below passing from rock, through bare scree to bilberry-covered scree in a fine concave sweep. The well-developed block-field on the Acid Volcanics of the summit-flat also gives way to peaty wet conditions on the mudstones.

The path in this section is not very distinct but the direction is given by a small lake on the ridge between Cwm Amarch and the small southwestern cirque (whose head is cliffed only on the southeast facing side). Beyond this lake, the steep descent (grassed) is made southwards to the stream and wall which may be followed southwestwards to the gate leading to the farm (Rhiw'r ogof), lying on a

conspicuous valley bench. Where the lane from the farm reaches the edge of the bench a fine view of the Tal y llyn valley is obtained, from the gap at its head downstream to Abergynolwyn. The general features of the trough stand out clearly—its steep furrowed southern side falling to the screes below, the valley lake and its enclosing bar, ridged and gorse-covered to the south of the stream outlet but smoother and grassed on the north bank. Rising abruptly above this gorge section is a conspicuous bench on the southern valley side (at an average height of 450 feet O.D.). The limited exposures on the outer scarp of this bench show only angular scree-like debris, suggesting that it may have been built up by frost on this northern face of Graig Goch, possibly between the hill-side and a shrinking ice tongue. Its position is below the screes most active at the present time, and further similar benches showing no solid rock, but having the appearance of drift, occur downstream—all below this over-steepened face of Graig Goch. The south-facing side of the valley on the other hand does not exhibit comparable features.

Exposures showing the mudstones which form the bar enclosing Tal y llyn Lake occur on the road side where the stream cuts through (just behind Pen y Bont Hotel) and on the southwest corner of the lake, where rock has been exposed to a height of 5–10 feet for a distance of some 75 yards. In the gorse-grown field south of St. Mary's Church many outcrops may also be seen.

Finally, the average time taken over this route by student parties and conference groups from Aberystwyth may be of interest:— Minffordd arrive 10.50 a.m.; lunch at rear of Llyn Cau, 12.45–1.15 p.m.; summit depart 3.00 p.m.; St. Mary's Church and Ty'n y Cornel Hotel 4.30 p.m.

REFERENCES

[1] A. H. Cox, "The geology of the Cader Idris Range", *Quart. Journ. Geol. Soc.*, vol. lxxxi, 1925, p. 539.

[2] A. H. Cox and A. K. Wells, "The geology of the Dolgelley district, Merionethshire", *Proc. Geol. Assoc.*, vol. 38, 1927, pp. 265–318; see esp. pp. 311–17.

[3] *Ibid.*, p. 314; "Most, though not all of the rejuvenation and river-capturing must have long antedated the Glacial Period".

[4] D. L. Linton, "Watershed breaching by ice in Scotland", *Trans., Inst. British Geographers*, Publ. No. 15, 1951, pp. 1–16.

[5] W. V. Lewis, "A melt-water hypothesis of cirque formation", *Geol. Mag.*, vol. lxxv, 1938, p. 263; J. K. Charlesworth, *The Quaternary Era*, vol. 1, pp. 297–8, London, 1957.

[6] R. G. Davies, "The Cader Idris Granophyre and its associated rocks", *Quart. Journ. Geol. Soc.*, vol. cxv, 1959, p. 189.

[7] R. G. Davies, *op. cit.*

[8] G. M. Howe and R. A. Yates, "A bathymetrical study of Llyn Cau", *Geography*, vol. xxxviii, 1953, p. 124.

# The Neuwied Basin

T. H. ELKINS AND E. M. YATES

THE TRAVELLER WHO FOLLOWS THE RHINE on its famous course through the Rhenish Uplands of Germany, whether he enters from Bingen in the south or Bonn in the north, finds himself at first in a narrow gorge, with sides falling almost sheer to the river from the level of the High Terrace, some 300 to 400 feet above. Halfway through the massif, however, the steep sides recede and reveal a sheltered and productive lowland, where towns and industries crowd along the river; this is the Neuwied or Middle Rhine Basin.* It is a region worthy of study because, in its structural and morphological complexity, it exemplifies the surprising diversity of terrain to be observed within the Rhenish Uplands, a massif all too commonly dismissed as monotonous and uniform. As a region too, it is of critical importance for explaining the evolution of the Rhine drainage. Nor is it devoid of human importance; its loessic and volcanic soils are much more attractive than the thin soils of the surrounding uplands; it has a group of extractive industries of almost unparalleled interest; and it has all the strategic significance of the meeting place of Rhine, Mosel and Lahn.

### THE DEVELOPMENT OF THE BASIN

The Rhenish Uplands consist of a great series of Devonian sediments, intensively folded and much faulted. They once formed part of the Hercynian mountains, but by Oligocene times had been reduced to a low-lying peninsula with a relief of the order of 200 metres, and a drainage pattern which was radically different from that of today. The Neuwied Basin was at this time probably a shallow lake but in the Upper Oligocene the sea occupying the Mainz–Hesse Basin, south and east of the Rhenish Uplands, transgressed northwards along the route later to be followed by the Rhine. It invaded the Neuwied Basin, leaving as evidence the clays now exposed, for example, in a deep pit at Kärlich. The linkage was only temporary. Eventually the warping and tilting of the peninsula broke the link to the south, whilst the relative down-faulting of the Neuwied Basin disrupted the old drainage pattern and helped to establish the present linkage of the Mosel and the

➤ Mr. Elkins and Dr. Yates, both lecturers in geography in University of London King's College, directed jointly the Geographical Association's Summer School in Germany in August 1958, during part of which a field study was made of the Neuwied Basin. Their regional description of the area may serve as a basis for map interpretation and study; the relevant maps are 1:50,000, sheets L5508 (Ahrweiler), L5510 (Neuwied) and L5710 (Koblenz); coloured, with contours and hill shading, they may be purchased from R. V., Stuttgart, Gutenbergstrasse 21, at 3 DM. each.

* There is some confusion of nomenclature. British geographers, following the common usage of German geologists, mostly prefer to use the term "Neuwied Basin" for the whole of the lowland shown on Fig. 1. German geographers usually call this the "Middle Rhine Basin" (*Mittelrheinische Becken*), reserving the term *Neuwieder Becken* or *Neuwieder Talweitung* for the lowest area in the northeast.

Lahn with the Rhine.[1] At this stage the Rhine drainage was still contained within the Rhenish Uplands. Then in Pliocene times the Rhine, by headward erosion along the route followed by the Oligocene sea from the Mainz-Hesse Basin, reached the Rift Valley and captured its drainage. From south of the massif the river brought great quantities of white quartzite pebbles (the Kieseloolith Beds) which now characterize its higher terraces of Pliocene age. The Rhenish Uplands have continued to rise since the Pliocene, but by cutting its great gorge the Rhine has been able to maintain its course across the massif.

This sequence of events has led to the development of the Neuwied Basin as a down-faulted area of Tertiary and Quaternary materials measuring some 30 by 15 kilometres (Fig. 1). In these less resistant rocks the Rhine has widened its valley, so breaking its gorge into two distinct sections, that below Bingen and the part above Bonn. Physiographically the basin consists of an area of lowland, at about 200 metres or below, set in an upland much of which is over 500 metres. In detail, the relief owes much to two events of Quaternary times—vulcanicity and the formation of the younger terraces of the Rhine.

### THE VOLCANIC LANDSCAPES

The rise and tilt of the Rhenish Uplands was accompanied by periods of vulcanism. The Siebengebirge, a complex group of volcanoes at the southern apex of the Cologne Bay, were formed in the Oligocene. In Miocene or Pliocene times occurred the basalt flows of the Westerwald. In the Eifel exact dating of the earlier vulcanicity is difficult, but Hohe Acht (746 metres), a basalt cone which forms the highest point in the Eifel, is possibly of Pliocene age. The vulcanicity of the Neuwied Basin is even younger, and in location is clearly associated with the bounding fault lines. Its first phase probably occurred in the mid-Pleistocene along the western boundary between Ettringen, Weibern and Wehr, resulting in the development of a number of phonolite cones and a mantle of phonolite tuffs (Fig. 2). This complex of cones and lava flows, deeply dissected by the Upper Nette, forms an area of distinctive scenery which contrasts in its ruggedness both with the peneplained uplands and with the interior of the basin.

The second phase of vulcanism was more widespread, continuing until late glacial time. In consequence, erosion has had little chance to destroy the characteristic volcanic landscape of cones, lava flows, craters, maars mudstreams, and tuff sheets.[2] The numerous cones are generally of basalt ash, and although wooded their fresh forms meet the smooth terraces of the basin on which they stand with a sharpness of angle unusual in a fluvial landscape. The major crater north of Mayen has been broken by two lava streams, one to the north and one to the south. The divided crater wall forms Ettringer Bellerberg (13) and Kottenheimer Büden (15)* whilst to the south is a small parasitic

* The numbers give the position of the cones on Fig. 2.

cone, Mayener Bellerberg (14) (Fig. 3, i). This existed before the southward lava stream so that its base is enveloped in basalt. Kunkskopf (12) is a further example of a parasitic cone, standing on the edge of the older crater of Kunksboden (Fig. 3, iii and Plate I facing p. 96).

The basalt lavas which issued from the craters are most important in the west. There are two major flows, at Mayen and at Niedermendig, and many minor ones. The Mayen flow forms a flattened tongue extending southwards into the basin (see Fig. 3, i) from the craters of Ettringer Bellerberg (13) and Hochsimmer (16). The basalt from Ettringer Bellerberg and the uppermost basalt in the Niedermendig tongue are finely vesicular, whereas all the other basalts from the basin are coarsely pored, a factor of considerable historical importance. Niedermendig is situated to the south of its basalt tongue, between it and a further minor tongue which reaches Thur (Fig. 3, iii).

Following the basalt outpouring and the formation of the ash cones the vulcanicity terminated with a series of great explosions leading to the formation of explosion craters or maars, and the deposition over the basin of a trachyte pumice, the Bims.[3] This material, generally light grey and sufficiently porous to float, forms sheets of as much as 25 metres in thickness, the individual fragments varying from dust to particles of a few centimetres (Plate II facing p. 96). The ejection of such tuffs had occurred earlier, but the last explosions appear to have been the most violent and to have furnished the greatest volume of tuff. The explosion craters from which the Bims was blown were at least eight in number, but only three have any surface expression, the others being covered beneath tuffs blown from later explosions. These three are the Laacher See, the Wehr Maar and Meerboden, a small depression north of Niedermendig (see Fig. 3, ii). In many Bims exposures the lower tuff is from Meerboden. Above this comes a thick dust horizon, the *Hauptbritzbank*, and then grey Bims from the Laacher See.[4]

The three explosion craters are situated on the northwest of the basin, but the pumice sheets all lie towards the east owing to the obliquity of the vents and presumably to the prevailing winds at the time of the explosion. That the vents were inclined is demonstrated by the distribution of basalt bombs thrown out in the explosions. These also lie to the east, although too heavy to have been much affected by the wind. The explosions were of sufficient violence to destroy any ash cones that may have existed near the vent; the cones around the Laacher See form a ring simply because those formerly occupying the site of the lake have been blown away. The lake which occupies the depression left by the explosions, together with the surrounding wooded cones, provide the setting for the ancient abbey of Maria Laach on the southern shore. Carbon dioxide still bubbles to the surface of the lake, the last phase of vulcanicity.

The Bims is found not merely within the basin; Bims dust reached as far as Halle (Saale), and its presence in various peat bogs provided

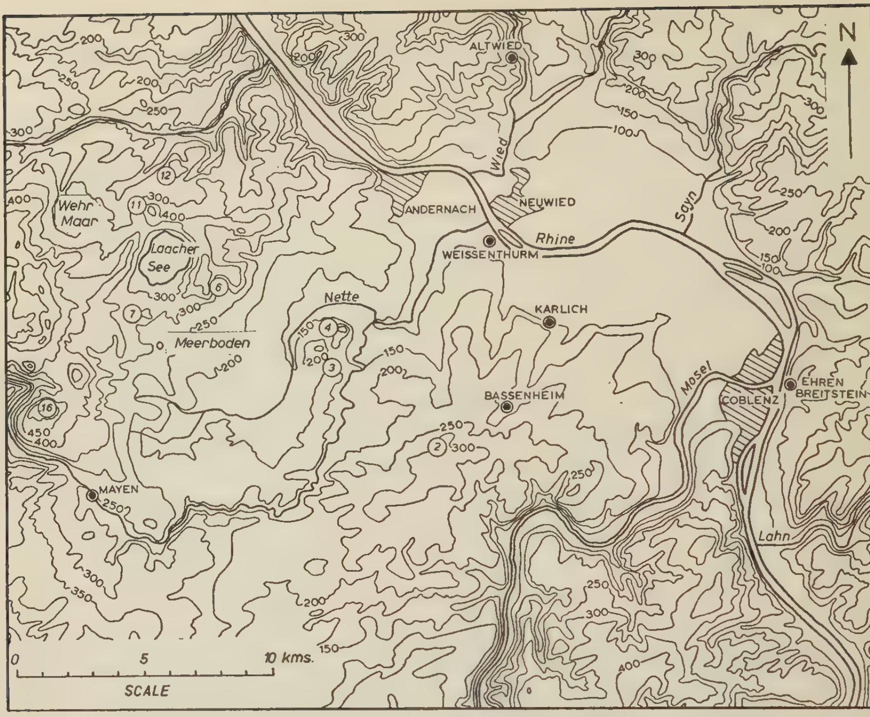


Fig. 1.—Relief of the Neuwied Basin. For Key to numerals, see Fig. 2.

an opportunity for dating the explosions by pollen analysis. The period proved to be that of the Allerød, the short warm phase in Late Glacial times. As will be seen, further chronological evidence is provided by the Trass.

The explosions produced immense clouds of fine dust which were turned by the accompanying heavy rains into great streams of mud. These flowed down into the Nettle and Brohl valleys. The fine material of these mud streams has been subsequently consolidated by the ground water into a soft rock, the Trass, which constitutes another important mineral resource of the Neuwied Basin. The mud stream in its movement down the Brohl valley overwhelmed a camp site of early men hunting the game of a birch-pine forest. Their artifacts confirm that the date of the Laacher See explosion was as recent as about 9000 B.C.

## THE TERRACE LANDSCAPES

The Rhine terraces widen in the Neuwied Basin but the fact that down-faulting has continued until recent times makes difficult their correlation with terrace remnants up and down stream (Fig. 1). On the southern edge of the basin Karmelenberg (2) stands on the Kieseloolith gravels of the Pliocene Terrace at 320 metres. In the Andernach Gate, where the Rhine leaves the basin for its northern gorge section, the same terrace is present at the same height, yet immediately on the north

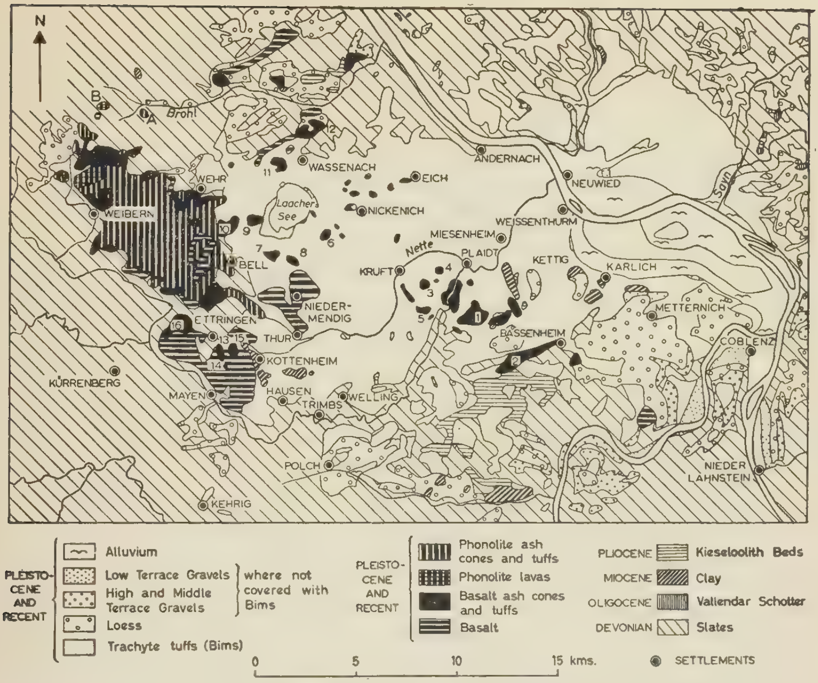


Fig. 2.—Geology of the Neuwied Basin. The principal basalt ash cones are numbered; the principal phonolite ash cones are lettered.

| | | |
|---|---|---|
| 1. Wannenkopf | 7. Thelenberg | 13. Ettringer Bellerberg |
| 2. Karmelenberg | 8. Wingertsberg | 14. Mayener Bellerberg |
| 3. Korretsberg | 9. Laacher Kopf | 15. Kottenheimer Büden |
| 4. Plaidter Hammerich | 10. Rotenberg | 16. Hochsimmer |
| 5. Tönchesberg | 11. Veitskopf | A. Olbrück |
| 6. Krufter Ofen | 12. Kunkskopf | B. Perlerkopf |

side of Karmelenberg it has been downfaulted to 240 metres. This can be clearly seen in Fig. 1, where the straight 250 metres contour north of Karmelenberg marks the fault line. Similarly the High Terrace above Koblenz is at about 200 metres, and the same height is shown at Andernach, where the feature is a kilometre wide on either side of the river, incised into the Pliocene terrace. Between these points the High Terrace is considerably downfaulted, but this fact is concealed because it bears such a great thickness of Bims and loess, that a level of about 200 metres is maintained. The correlation in height between this broad feature developed within the basin by the mantle of unconsolidated materials resting on the downfaulted High Terrace, and the true High Terrace up and down stream, is both fortuitous and extremely misleading.

The same difficulty arises with the Middle and Low Terraces. Three distinct Middle Terraces are distinguished elsewhere along the Rhine, but the thick cover of Bims coupled with the downfaulting makes distinction difficult within the basin. The bluff separating the Middle Terraces from the Low Terraces is approximately marked by the 100 metres contour.

The Low Terrace is divided into an upper and a lower, but in contrast to the position with the Middle Terrace, distinguishing between the two is easier in the basin than elsewhere. This is due to the dates of the formation of the terraces in relation to the Laacher See vulcanism. The Upper Low Terrace was formed by the river before the outburst, and so is covered with Bims. The gravel surface of the terrace is between 61–64 metres, but this is increased by the Bims layer to approximately 70 metres. The Lower Low Terrace, at about 60 metres, has no Bims cover, since it was formed after the explosions, but rolled Bims is present in its gravels.[5] In Fig. 2 this terrace makes up the major part of the area mapped as alluvium. It is only 2–4 metres above the present Rhine flood plain, and is occasionally flooded. Neuwied stands upon it, whereas Andernach and Koblenz have a higher margin of safety, being mainly on the Upper Low Terrace.

The broadening of the Low Terrace in the Neuwied Basin is one of the most clear and striking features of the whole region (Fig. 1). Often as at Kärlich, hardly any Middle Terrace remains, and a pronounced bluff rises from the Upper Low Terrace up to the 200 metres surface described above. As a result, there is a marked internal division of the basin into the Low Terrace landscapes of the northeast, and the upper terraces of the southwest. The Bims is common to both, but it is only in the southwest that the older volcanic forms are present.

## AGRICULTURE AND RURAL SETTLEMENT

The Neuwied Basin forms an island of warmth and relatively low rainfall within the otherwise rather raw and exposed plateau of the Rhenish Uplands. In the lower parts of the basin, temperatures range from a January mean of 35° F. to a July mean of 64° F., with a rainfall of 20 to 25 inches. In contrast, the plateau immediately to the west of the basin has January 29° F., July 58° F. and 30 to 35 inches of rain a year. Soils, too, are favourable: the Bims weathers to a warm, easily worked soil.[6] As a result of the permeability of the Bims there are few streams, yet paradoxically its porosity provides a reservoir of moisture during dry periods. Even more favourable soils are provided by the loess.

It is not surprising that the well-drained and easily cultivated Bims land proved attractive to the Neolithic farmers when they arrived in Central Europe. Owing to numerous finds resulting from the quarrying of Bims, archaeologists have been able to build up an unusually complete picture of the settlements both of the Neolithic people, and of their successors in the Bronze and Iron ages. These discoveries add weight to the volume of evidence that has been collected against some of the older notions on the evolution of settlement in western Germany. It is no longer believed that the Neolithic immigrants found the areas of light, well-drained soils that they favoured open and clear of trees.[7] Neither is it now held that the cleared areas remained constant in

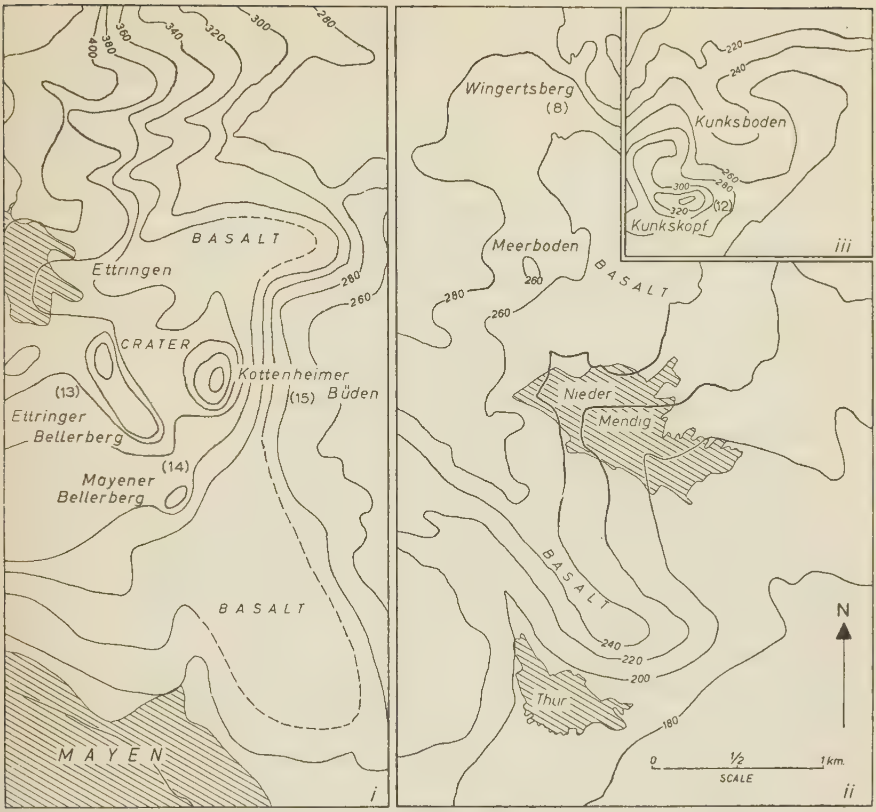


Fig. 3.—Volcanic relief forms: i. Basalt flows, breached crater, parasitic cone; ii. Basalt flows (directed southeast into the down-faulted basin), maar; iii. Breached crater of Kunkskopf on older breached crater of Kunksboden.

extent from Neolithic times down to the arrival of the Germans. In the Neuwied Basin, the Neolithic people appear to have practised a shifting cultivation associated with temporary clearings in the forest of oak, birch and hornbeam. Abandonment of the breaks seems sometimes to have been accompanied by the abandonment of the settlement. It is true that the settlements of the various prehistoric peoples, like the modern villages, appear to have occupied the same type of site, 'wet-point' for the most part. The dry Bims spreads were avoided in favour of sites near the Rhine, along the few streams, or on slopes where springs might be tapped. Yet few sites can be traced for long periods of time. Sooner or later they were abandoned, probably owing to soil exhaustion, and the forest crept back over the fields. Later waves of settlers would have to clear the trees again, and rarely chose exactly the same sites for their settlements.[8] Certainly the Franks, when they migrated into the area, found that woodland had closed over much of the basin during the troubled times after the middle of the third century A.D.

The evolution of a more stable and advanced type of agriculture, the open-field system, allowed the Frankish settlements to develop through the centuries into the large villages (*Haufendörfer* and *Haufenwegdörfer*) that are characteristic of the region today. The large Frankish farms, consisting of separate farmhouse, barn, cowshed and outbuildings grouped round a courtyard, do not stand in the midst of their fields but are concentrated into the villages. Even before the arrival of industry, some of the villages had nearly 1000 inhabitants. Today, manufacturing and extractive industries have swollen many small villages to the size of small towns, with the roads leading from them lined by small houses for the workers.

Although the old compulsory open-field rotation has been abandoned, most of the basin is still covered by unenclosed arable land. The patchwork of strip fields stretches for miles, unbroken except by widely spaced villages in their circle of gardens and fruit trees, and by the occasional wooded cinder cone, rising dramatically from the cropped land. The farms grow wheat, especially on the loess; potatoes, especially on the light Bims land; and malting barley. Maize and other fodder crops are grown for the cattle, which are kept in the farm buildings for most of the year. In the lower northeast of the basin, near the Rhine, the agriculture is more diverse. Fruit trees cover the terrace bluffs and slopes of tributary valleys, while beneath the trees and on the open Low Terrace below, small fruits and vegetables are grown.

## INDUSTRIES

Perhaps the most individual feature of the Basin is its concentration of mineral industries, which are, of course, closely related to the eventful geological history that has already been described. The oldest rocks of economic importance are the Devonian Hunsrück roofing slates, worked in shallow mines in the higher western parts of the basin, where the Devonian rocks are covered by only a thin layer of superficial deposits. Slate is the traditional roofing material in the Rhenish Uplands. The Tertiary clays of the basin are the basis for some of the heavier branches of the ceramic industry, mainly located on the Rhine. A notable example is the pit at Kärlich, mentioned above, which sends its clay by ropeway to a loading point on the Rhine, for making tiles and refractory bricks and for use in iron and steel casting.

Far more important are the various volcanic rocks. Querns and millstones have been made from the finely vesicular basalt lavas of the Mayen and Niedermendig lava flows since 800 B.C.[9] The rise of the modern quarrying industry, however, came after 1850, with the development of road and rail links with the Rhine. The surface of the lava flow above Mayen became a chaos of open pits and masons' yards, producing mill stones, door posts, kerb stones and the small paving setts that are still so common on German roads. At Nieder-

mendig, where the flow is thickly covered with Bims and loess, the lava was worked underground in a series of caverns. In the days before refrigeration, these were much favoured as beer cellars, so that Niedermendig achieved a short-lived importance as a brewing centre. Today the stone is worked in deep open pits and most of the breweries are derelict. In recent years, Mayen has prospered less than other German quarrying districts, as basalt has fallen out of fashion both for roads and for buildings. Its sombre colour is disliked, and it cannot be polished to make the thin slabs now so widely used in Germany for cladding buildings. The light-coloured trachyte tuff, long worked to the west of the Laacher See, suffers from a similar disadvantage, as it can be used only in unfashionably thick slabs.[10] Only the cinders of the cones themselves are in increasing demand for road making, the workings producing spectacular red scars on the dark green of the forested cones.

If the traditional stone-quarrying industry is tending to stagnate, the reverse is true of the working of the Bims deposits which cover much of the basin. Since up to 80 per cent of a fragment of Bims consists of air-filled pores, it is extremely light. About the middle of the last century it was found that, mixed with a binding material like lime (or, more recently, cement) Bims could be formed into excellent light-weight building blocks, resembling our familiar breeze or clinker blocks, but stronger. Today nearly half of the house building in West Germany is done with these blocks. The earliest workings were on the Rhine, in proximity to the major water, road and rail routes. Today workings extend eastwards far up the slopes of the Westerwald, but the greatest output comes from the basin west of the Rhine, where the layer of Bims is being steadily stripped towards the vents in the Laacher See neighbourhood from which it came.[11]

The working of the Bims causes little disturbance to agriculture; the top soil is taken off, the Bims is removed by mechanical excavator and, as the working face moves on, the soil is replaced at a lower level and re-seeded. The light but bulky Bims is normally loaded into large lorries and trailers for transport to the processing plants. Most of these are at some distance from the pits which serve them, owing to the speed with which the relatively shallow workings move across country. Modern Bims plants consist of a tower, up which the Bims is taken by a conveyor. In descending it is screened, crushed and mixed with water and cement. It passes downwards into a press, from which the formed blocks emerge on a horizontal belt for drying. About 6000 workers were employed in the industry in 1955, when the output of blocks reached 5·6 million tons. Transport to the consumer is almost entirely by lorries and trailers; the great amount of road transport used by the industry makes the basin notorious for traffic congestion. In addition, an increasing quantity of untreated Bims (4·5 million tons in 1955) is sent away, almost entirely by Rhine barge, for making into

blocks near the point of consumption. This reflects the greater cheapness of moving bulk Bims by water, compared with the cost of moving finished blocks in heavily taxed road vehicles.[12]

Another raw material is the Trass of the Brohl and Nette valleys. These mud flows were worked from Roman times for building stone (*Duckstein*), but acquired a new importance in the seventeenth century when exported to the Netherlands (under the name of Trass) for making a hydraulic mortar used in under-water construction.[13] Trass cement is still made at a works in Kruft, which also makes normal Portland cement from raw materials brought in by rail.[14] One further product of volcanic action is the carbon dioxide that emerges from fissures at many points in the basin, and which is trapped and compressed for use in the mineral waters industry.

Apart from the mineral industries, the Rhine within the Neuwied Basin has attracted a concentration of other plants. The presence of metal-working industries depended initially on a southern extension of the Siegerland iron orefield, which reaches as far as the north-eastern fringe of the basin. Until the middle of the nineteenth century this ore was smelted in small ironworks in the valleys of the Wied and Sayn, using charcoal and the water power of the streams. Following the failure of attempts to build an iron industry on the banks of the Rhine, using Ruhr coal and Lorraine ore, the steel works of the basin have concentrated on the further processing of iron and steel produced in Ruhr furnaces. The principal activity is the re-rolling of Ruhr steel to make steel sheet, galvanized sheet, and tinplate. The largest works are near Neuwied, one at a former water-power site in the Wied valley, another at a new site opposite the town on the west bank of the Rhine.

All of the plants which line the Rhine depend on the river or on the roads and railways which follow it for good communications, and many use either local raw materials or the products of neighbouring plants in their manufacturing processes. The engineering industry produces equipment for Bims processing, as well as for paper-making, printing and other machinery. Local fruit is used in preserving and canning factories, which also use tins made from local tinplate. There are colour works using Tertiary earths, and breweries and maltings which are, in part, based on barley grown in the basin. The large cement works at Neuwied supplies the Bims industry with the special cement it needs for binding the blocks. It receives most of its limestone from Rhine-Hesse, near Mainz, as a cheap downstream freight in coal barges that would otherwise have to return empty to the Ruhr.[15] It is curious that of the two cement works in the basin, Neuwied is a total exception, and Kruft a partial exception, to the general locational rule, that cement works are found in close proximity to their heaviest raw material, usually limestone.

### TOWNS

As might be expected, the important towns are found in the lower northeast of the basin, along the Rhine. The only exception of note is Mayen, with 17,000 inhabitants, the stone-quarrying capital and market town of the southwest, on the upland fringe. It is somewhat surprising that in this early settled and productive region, where the Rhine is joined by two of its major tributaries, there is no undisputed regional capital. Partly this is a matter of scale: the Neuwied Basin has not provided an economic base sufficient for a town that could stand up to political and economic encroachment from cities on the broader lowlands beyond the limits of the Rhenish Uplands. The Mosel and Lahn, too, are less significant than might appear; neither has any navigational importance today (1959), while their deeply incised and winding valleys hinder, as much as they assist, land routes. Partly, too, this failure to develop a major regional centre is a matter of history.

Even in Roman times, when the basin was a political unity, there were two towns, *Confluentes* (Koblenz) where the Roman route along the left bank of the Rhine entered the basin, and the larger *Antunnachum* (Andernach) where it left. The lack of a single dominant centre recurred in medieval times, when the basin, reflecting the political fragmentation of Germany as a whole, was divided between several states, each of which tried to stimulate the town on its territory. No state of importance developed in the basin itself, which however acted as a magnet for three ecclesiastical states with bases outside the massif.

The most successful was Trier, which seized Koblenz and most of the Rhine banks within the basin. Mainz, expanding from the south, reached only to Lahnstein, at the mouth of the Lahn, while in the north Cologne obtained Andernach and the left bank of the Rhine as far south as the mouth of the Nette. Cologne and Trier were able to prevent any rival to Koblenz and Andernach arising throughout medieval times. The weak link in their control was provided by the little buffer state of Wied, which from its capital of Altwied on the fringe of the Westerwald extended a wedge of territory between the lands of the two larger states to reach the Rhine. The right bank of the river at this point consists of Lower Low Terrace gravels and alluvium, and is liable to flooding. On this indifferent site Neuwied, the third of the towns on the Rhine, was founded in the seventeenth century.

The largest town, Koblenz, was in Roman and medieval times scarcely a Rhine town at all; it was in both periods a small fortified settlement where the route along the left bank of the Rhine crossed the Mosel, just above the confluence. From the end of medieval times, the Archbishops of Trier increasingly resided at Koblenz, as their old capital became more and more a frontier town, with the advance of the French towards the Rhine. As a minor capital, Koblenz continued to expand in the seventeenth to eighteenth centuries; a new

aristocratic and palace quarter for the first time linked the town with the Rhine.

Koblenz has evolved predominantly as a garrison, administrative, residential and commercial town. Its defences, including the fortress of Ehrenbreitstein on the High Terrace across the river, made it one of the great strong-points of nineteenth-century Germany. Until 1945 it was capital of the Prussian Rhine Province, and after the second world war it regained some importance as an army centre. Its department stores, entertainments, hospitals and other central facilities serve a wide area in the basin and the adjoining Rhenish Uplands. Nevertheless, recovery from great wartime destruction was slow by West German standards; the population in 1956 was 88,000, compared with 91,000 before the war.

Downstream, Andernach remains very much the small Rhineland town, with narrow, crooked streets within a circuit of medieval walls and towers. It has since Roman times been the loading point for stone from the Mayen area. Very different is Neuwied, across the river.[16] This is a seventeenth-century planned town, with a rectangular pattern of broad streets and avenues laid down by the Prince of Wied. To people his new town the prince took the unusual step, for the period, of granting shelter and religious toleration to a variety of Protestant sects, notably the Moravian Brethren. Their integrity and industry made eighteenth-century Neuwied prosperous, both from commerce and from skilled manufactures, like cabinet-making. In the present century, Neuwied has experienced a new period of growth. Industry has developed along the Rhine, and road transport has given it new importance as a regional centre. Its influence extends not only east of the Rhine but across the new Rhine bridge into the former sphere of influence of Andernach.

In a human sense, the basin is a microcosm of western Germany. The evolution of its nucleated rural settlement could stand as a pattern for most of the early occupied areas in the centre and south of the country. Political fragmentation, and the consequent multiplication of towns, also mirror conditions in western Germany as a whole. Similarly the way in which the divided basin fell in the past under the political control of outside powers like Trier and Cologne, and looks today for social and economic leadership to Cologne and Frankfurt, reflects in miniature the way in which Germany as a whole, in the long centuries of disunity prior to 1871, fell prey to outsiders like the French, the Danes and the Swedes.[17]

In much the same way, the Neuwied Basin is physically representative of one of the essential elements of the Hercynian Central Uplands of Europe, that is the faulted basin with its infill of young sediments. It is of the same genus as the Bovey Tracey Basin on the fringe of Dartmoor or the Limagne in the Central Massif. On the other hand, the Basin has many distinctive characteristics, notably its vulcanicity, the related

mineral industries, and above all the role it assumed in the evolution of the Rhine. The downfaulting of the basin was a prerequisite for the development of the river as the sole fluvial link between the three structural zones of Western Europe: the Alps, the Central Uplands, and the Northern Lowland. In this role, of such immense importance to the economic life of Western Europe, it is unique.

REFERENCES

[1] C. Mordziol, *Der geologische Werdegang des Mittelrheintales*, Wittlich, 1951.
[2] M. Hopman, O.S.B., J. Frechen and G. Knetsch, *Die Vulkanische Eifel*, Wittlich, 1951.
[3] W. Ahrens, "Die Entstehung des Laacher Sees und die Ausbruchstelle der Weissen Bimsstein des Neuwied Beckens", *Jahrbuch der Preussischen Geologisches Landesanstalt*, 1928, pp. 339–69; and "Uebersicht über die Geologischen Verhaltnisse der Laacher Seegebiet", *Verhandlungen des Naturhistorischen Verein der Preussischen Rheinlande und Westfalen*, vol. 85, 1928, pp. 109–29.
[4] J. Frechen and C. Mordziol, *Der Rheinische Bimsstein*, Wittlich, 1953.
[5] D. Gurlitt, "Das Mittelrheintal", *Forschungen zur deutschen Landeskunde*, vol. 46, 1949.
[6] E. Meynen and J. Schmithusen (eds.), *Handbuch der naturraumlichen Gliederung Deutschland*, 4 Lieferung, Remagen, 1947, pp. 422–7.
[7] A. Garnett, "The loess region in Central Europe in prehistoric times", *Geographical Journal*, vol. 106, 1945, pp. 132–43.
[8] J. Röder, "Die Besiedlung des Bims", *Rheinische Bimsbaustoffe*, Wiesbaden-Berlin, 1956, pp. 31–8.
[9] J. Röder, "The quern quarries of Mayen in Eifel", note in *Antiquity*, 1955, vol. 29, p. 68.
[10] K. Hottes, "Die Naturwerksteinindustrie in der Bundesrepublik Deutschland", *Geographisches Taschenbuch* 1958–9, Wiesbaden, 1958, pp. 322–35.
[11] H. Rath, "Geschichtliche Entwicklung der rheinischen Bimsindustrie seit dem I Weltkrieg und ihre Organisation", *Rheinische Bimsbaustoffe*, Wiesbaden-Berlin, 1956, pp. 55–74.
[12] K. Hottes, *op. cit.*
[13] R. Martiny, "Kulturgeographie des Koblenzer Verkehrsgebietes", *Forschungen zur deutschen Landes- und Volkskunde*, vol. 18, 1909, p. 454.
[14] K. Hottes and R. Klöpper, "Die westdeutsche Zementindustrie", *Geographisches Taschenbuch* 1954–5, Wiesbaden, 1954, pp. 291–301.
[15] K. Hottes and R. Klöpper, *op. cit.*
[16] Th. Kraus, "Neuwied", *Berichte zur deutschen Landeskunde*, vol. 16, 1956, pp. 25–45.
[17] R. Klöpper and J. Korber, *Rheinland-Pfalz in seiner Gliederung nach zentralörtlichen Bereichen*, Remagen, 1957.

# Methods of Soil Study

JAMES A. TAYLOR

AT EVERY LEVEL OF GEOGRAPHICAL EDUCATION in this country the teaching of soils is far from adequate. The enslavement of much of grammar school geography to the requirements of external examination syllabuses has engendered a rigid and unhealthy emphasis on global rather than local soils, and on the distribution and textbook appearance of the familiar continental sweeps of podzols, chernozems and laterites etc. rather than the direct study of local brown earths and gley soils, and the processes which created them and which operate within them. In the secondary modern school, however, the flexible nature of the time table should surely have encouraged the adoption of soil studies with adequate combinations of elementary field and laboratory work. Some teachers may feel that the soil is too complex a medium for young minds; yet almost half a century ago Sir John Russell himself, after successfully teaching soils to village school children at Wye in Kent, embodied an opposite opinion in his book *Lessons on Soil*.[1] The series of simple field and laboratory experiments illustrated in this work provides an elementary understanding of the soil as an active and reactive system, and, if adapted to a local area, would enable a geography teacher to re-orientate his lessons from an exclusively global to a more realistically local setting.

Again, at the top of our educational ladder in colleges and universities soil studies have been, almost traditionally, neglected. Many advanced regional and even physical texts deal most perfunctorily with soils; and the availability in university geography departments of specialist instruction in soils, their field study, classification and mapping, has been distinctly limited. This neglect of soil studies by British geographers is symptomatic of the slow and late development of pedology itself in this country in contrast to earlier progress in the U.S.S.R. and the U.S.A. Whilst Dokuchaiev[2] was laying the foundations of soil science in Russia in the late nineteenth century, Murchison's[3] policy of concentrating the attention of the British Geological Survey on "solid" and not "drift" deposits meant that the soils of these islands were to be virtually ignored for half a century. It was not until the late 1920s that Robinson,[4] building on earlier work by Hall,[5] initiated soil study and soil survey in North Wales which continued until the outbreak of war in 1939. Pre-war interests in the chemistry of artificial

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manuring in agriculture then achieved national importance with the need to intensify home food production. In the post-war period, the emphasis on the chemistry of soil fertility and on plant nutrition has been maintained. Impressive though this phase has been, it has meant inadequate appreciation of the more permanent physical and geochemical characteristics of soils and their parent materials, and of the relation of land geometry to soil properties, including soil climate, in the field. The geographer's contribution is plainly indicated here.

The needs of the present situation with regard to soil studies and soils teaching in the United Kingdom are therefore clear. It would seem desirable and necessary to introduce and extend soil study at all levels of our geographical teaching. Such a policy would include the study of the soil *per se*, which involves just as much geographical method as the study of the soil in relation to the total physical environment and to man's past and present activities. The first, and by far the best, method of studying soil is *in situ* in the field. This implies at once an orientation of our teaching and examination requirements to local as well as global examples. A range of field methods adaptable to each level of education should be evolved and individually applied according to the needs of each school or college and its accessibility to characteristic areas of particular soil types. It is also essential to introduce elementary laboratory work at school and selected advanced laboratory work at university for those specialist geographers who require it.

These aims can best be achieved by teaching not so much the bare facts about standard global soils but rather by explaining the stage of development reached by selected local soil profiles in relation to their genesis, evolution and, very frequently, human utilization. In other words, the question of how the soil has reached a particular stage is just as important in its interpretation as questions relating to where the soil is located (site, position and drainage factors) and what pattern of profile it possesses (sequence of horizons and their properties). Hypothetical, two-dimensional representations of soil profiles are merely fixed "stills" in a constantly changing picture. It is by the three-dimensional approach that contemporary soil patterns can be most effectively taught and understood, and, ultimately, a four-dimensional view to accommodate the time element is equally indispensable. An example (Fig. 1) will help to elucidate the point, and, in addition, explain why the brown earth is in many ways a more profitable starting point than the full podzol for the teaching of British soils.

In Fig. 1 an idealized vertical section (b) and an idealized corresponding block diagram (a) illustrate the relations of the podzol (profile 4), the brown earth (profiles 5, 6 and 7) and the gley soil (profiles 9 and 10) within the framework of a theoretical hydrological transect from high plateau above 1000 ft. O.D. through upper, middle and lower slopes to valley bottom at 200 feet to 300 feet O.D. The

advantage of the use of the vertical section is to demonstrate the lateral continuity or discontinuity of soil horizons, often, but not always, thickening downslope and thinning upslope in wedge-like layers or rounded lenses. Only the fringes of the high plateau are characterized by the fully developed, mature, textbook podzol (profile 4), in this instance with iron pan. More widespread and typical of the high moorlands such as those of Highland Britain is the peaty gley podzol (profiles 2 and 3). Here a considerable thickness of surface, acidic organic matter overlies an A horizon whose sticky, almost cheesy, appearance is entirely the opposite of the loose consistency of the bleached layer of the normal podzol. There is also a colour difference. The water-logged $A_2G$ horizon of the peaty gley podzol has a grey–yellow or grey–green colour in contrast to the lighter ash–grey $A_2$ horizon of the normal podzol, which may be represented above the $A_2G$ layer as in profile 3. The water-logging may be due to the development at the top of the B horizon of an iron pan ($B_1$) which restricts the downward movement of soil water, and produces a feature again untypical of the deeply leached, normal podzol profile. Alternatively, the iron pan may be formed as a result of previous water-logging. The pan, often prominent in Scottish examples,[6] is usually thin ($\frac{1}{8}$ inch) but continuous and wavy (see Fig. 1 (a)). The B horizon in some podzols may develop an indurated layer ($B_3$) at its base as in profile 3, which may also be represented downslope in the brown earths. Again the top ($B_1$) of the B horizon in the maturest of podzols (e.g. profile 4), and in some Welsh examples,[7] may be characterized by an indurated accumulation of leached organic matter; in such instances the iron pan may be absent.

Below the high plateau, the downslope sequence from shallow to deep brown earths and from excessively drained to imperfectly drained profiles is the simplest and most teachable part of the sequence. Textbook over-indulgence may label the brown earth as generally uniform throughout the profile, but in practice the agricultural top soil is followed by a $B_2$–$B_3$ sequence indicating textural changes. Much of Lowland Britain and the lower parts and lower plateaux of Highland Britain are covered with variants of the brown earth *provided drainage is not impeded.* Deterioration of drainage downslope is expressed in an elevation of the water table and an increase in the amount of gleying in the profile, first in the deeper horizons (profile 8) and then in the shallower horizons (profile 9). Finally, fully waterlogged conditions promote the formation of deep basin peat (profile 11) above thick layers of heavy, gleyed material. It is important to stress the genetic difference between the basin peat (profile 11) and the hill peat (profile 1). Basin peat is derived from waterlogged conditions in an area of flat or concave relief in valley, coastal flat or plain. Hill peat is primarily the expression of hill climate with its repetitive excess of precipitation over evaporation under conditions of relatively low temperature.

Fig. 1(a)

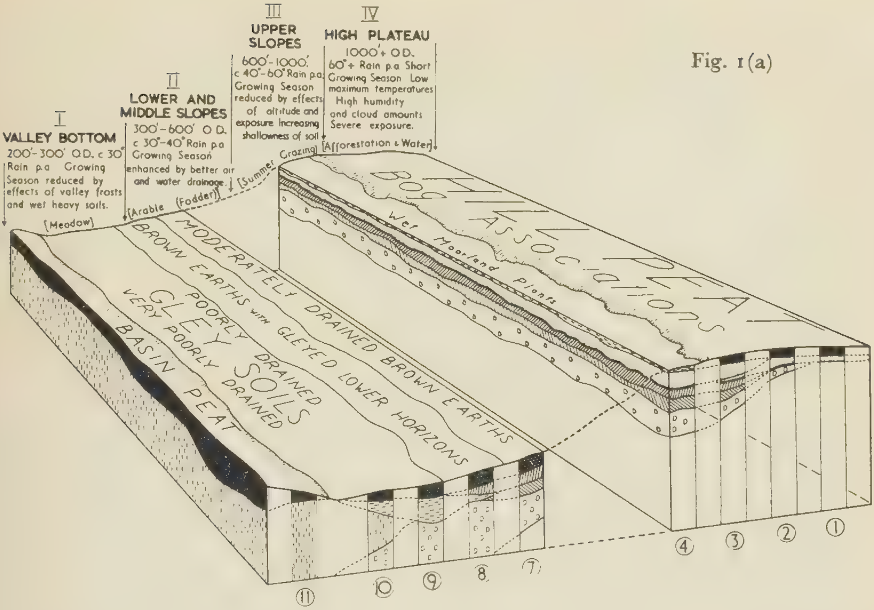



Fig. 1(b)

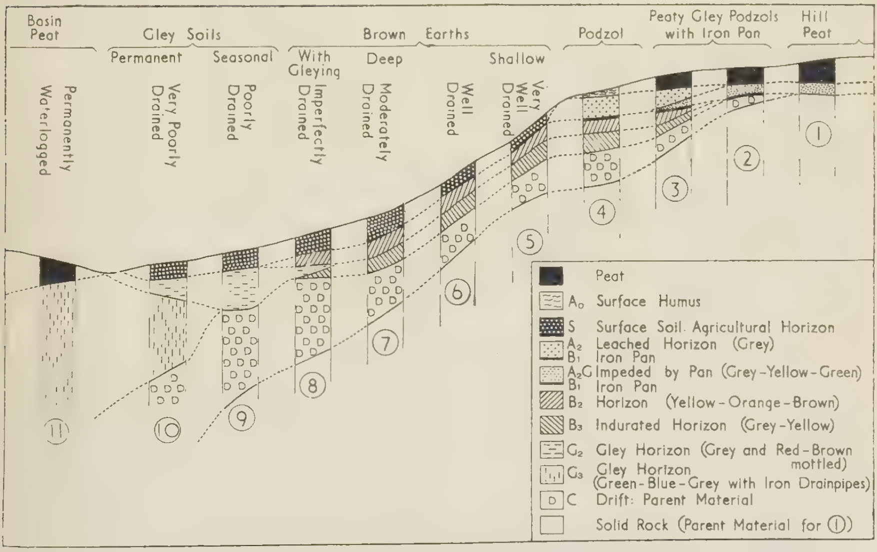



Fig. 1.—Idealized (a) block diagram and corresponding (b) vertical section showing a hydrological transect of soil profiles ranging from peat moorland to adjacent valley bottom. The transect refers in particular to slopes in the highland zone of Britain. The relations of soil profiles to altitude, slope, parent material, climate, vegetation and land use are demonstrated.

The profiles discussed above are displayed in three-dimensional form in Fig. 1 (a) where the podzol has been deliberately selected for exposure. Its horizons though distinctive are complex and variable due to the effects of peaty accumulations, iron pans and gleying. The

fully mature podzol is a relatively rare occurrence in the field in the United Kingdom. The best examples, ironically enough, occur on the intensely leachable, sandy deposits in parts of the Lowland Zone (e.g. the Breckland of East Anglia) with rainfalls of less than 30 inches per annum, attesting the need for parent materials to be very permeable and acidic in reaction for full podzolization to develop. Brown earths, on the other hand, are not only much more frequent and accessible in the field in many districts, but also display simpler and rather less variable profiles which constitute a central point in a normal hydrological sequence. It is true that many brown earths have a cultivated top layer but inspection of sub-soils should reveal pedological characters. Once the fundamentals of the brown earth profile have been grasped, the introduction of the two extremes of the sequence can be attempted. Progressive deterioration in drainage downslope induces gleying; alternatively progressive amelioration of drainage upslope promotes podzolization provided parent material and vegetation factors are favourable. Again, gleying and gley soils, however artificially well drained they may be, are much commoner and perhaps more consistent in the field than podzolization and podzols, the complexity and rarity of which should be stressed. Figures 1 (a) and (b) refer essentially to Highland Zone conditions. Similar diagrams might be compiled for the scarp and vale areas of the Lowland Zone along the lines suggested by Henderson and Bird[8] and Avery.[9]

One of the major impediments to progress in soils teaching has been the scarcity of information and advice on appropriate field and laboratory methods and equipment and how to use them. The following summary should assist any teacher in the selection and, if necessary, the simplification of methods suitable to the calibre of his pupils, the range of his courses and the scope offered by the types of country within reasonable reach of the school or college.

## FIELD AND LABORATORY METHODS OF SOIL STUDY

The following methods have been selected for detailed discussion later:

(i) Preliminary reconnaissance, using field evidence listed originally by Dokuchaiev[10] but including, with certain reservations, some contemporary techniques involving aerial photographs (see Fig. 2) when available (*vide* Clarke[11]), and simplifications of the land-form mapping techniques recently advocated by Waters.[12]

(ii) Handling, squeezing, fingering, and wetting the surface and, if accessible, deeper soil samples, to classify their textures.

(iii) Extraction of soil samples by using augers, corers, or borers.

(iv) The use of instruments to examine certain soil properties *in situ*, e.g. the estimation of pH values; the application of dilute hydrochloric acid to detect the presence and proportion of carbonates in the soil according to the degree of effervescence; or the use of the Munsell Soil Color Chart[13] to determine soil colours.

*Key to Fig. 2*

*Descriptions of Soil Series (Soil Series first recognized by the Soil Survey of Wales)*

| *World Group* | *Series* | | *Location* | *Drainage* | *Land use* | *Parent Material* |
|---|---|---|---|---|---|---|
| | *Name* | *Symbol* | | | | |
| Shallow Brown Earth | Powys | P | Convex tops of knolls, swells and ridges; slightly convex upper slopes; rock outcrops sometimes interspersed | Free or very free; sometimes excessive | Usually poor grassland or rough grazing with dwarf gorse and trees; arable limited by shallowness and tendency to dry out | Drift-free Silurian shales and grits |
| Deep Brown Earth | Penrhyn | $P_1$ | Middle and lower middle slopes of concave or even surface | Free | Arable or permanent grassland; superior agricultural potential to Powys; deeper and less tendency to dry out | Variable depths of transported materials derived from Silurian shales and grits; much of these materials is drift but some is probably due to gravitational down-slope movements |
| Brown Earth with gleyed lower horizons due to seasonal ground water impedance | Sannan | $P_2a$ | Lower concave slopes and almost flat ground just above the bottoms of depressions | Imperfect | Permanent grassland or arable; moderately good agricultural potential provided artificial drainage is satisfactory | Substantial depths of transported Silurian shale and grit material as for Penrhyn above, but deeper |
| Ground Water Gley | Cegin | $P_2$ | Basin or trough sites with flat or slightly concave relief | Poor | Rough grazings or rushy pastures | Deep drift derived from Silurian shales and grits |

(continued)

*Key to Fig. 2—continued*

*Description of Typical Profiles*

| *Series Name* | | *Profile Description* |
|---|---|---|
| Powys | 0–8 in. | Variably shallow dark grey brown (Munsell Colour: 10 YR 4/2–4/3) silt loam with many shale stones. Moist; crumb structure; porous; friable; moderate to high organic content. Abundant roots especially in the top 2 in. Occasional earth worms. Becoming slightly darker with depth passing into parent material. |
| | Below 8 in. | Parent material consisting of Silurian shales and grits. |
| Penrhyn | 0–7 in. | Dark brown to dark yellowish brown (10 YR 4/3–4/4) silt loam with numerous shale stones. Moist; crumb structure; porous; friable; moderate organic content. Frequent roots; earth worms present; merging boundary. |
| | 7–18 in. | Yellowish brown (10 YR 5/6–5/8) loam to clay loam, very stony. Moist; poor structure due to stoniness; moderate organic content; very porous; loose and friable; occasional roots; a few earth worms in upper part of horizon; merging boundary. |
| | Below 18 in. | Yellowish brown (10 YR 5/8) but becoming paler than above; otherwise as above with abundant stones and low organic content. |
| Sannan | 0–6 in. | Grey brown (2·5 Y 5/2) silt loam with rare shale stones; occasional faint rusty mottling along old root channels. Moist; small cloddy and crumb structure; porous; friable; moderate organic content; frequent roots especially in the top 2 in.; earth worms present; merging boundary. |
| | 6–12 in. | Light brownish grey (2·5 Y 6/2) silt loam with occasional rusty mottling as above, almost stoneless. Moist; weak cloddy structure; porous; friable but more compacted than above; moderate organic content; occasional roots; some earth worms; fairly sharp boundary. |
| | Below 12 in. | Light olive grey (5 Y 6/2) silt loam to silty clay loam with rusty brown mottling, increasing with depth; occasional shale stones. Moist; weak prismatic structure; compact and rather tenacious; very few roots or earth worm tracks, increasingly rare with depth; low organic content. |
| Cegin | 0–3 in. | Light brownish grey (2·5 Y 6/2) silt loam with rusty mottling along root channels; virtually stoneless. Moist; large cloddy structure; porous; friable; moderate to high organic content; abundant roots; earth worms present; fairly sharp boundary. |
| | 3–7 in. | Light grey (5 Y 7/2) silt clay loam with occasional strong brown mottling and small shale stones; moist becoming wet at base of horizon; otherwise as above; fairly sharp boundary. |
| | Below 7 in. | Light olive grey to pale olive (5 Y 6/2–6/3) silty clay loam with strong brown to reddish yellow mottling (7·5 YR 5/8–6/8) inside structural units and light grey (5 Y 7/2) faces to prisms; weak prismatic structure; moist; porous only through fissures; tenacious; occasional roots and worm tracks decreasing with depth. Stronger prismatic structure and dominantly grey (5 Y 6/1) with pale olive (5 Y 6/3) and strong brown (7·5 YR 5/8) mottling with increasing depth. |

(v) The digging of soil pits to reveal the nature and disposition of soil horizons, and to enable the systematic selection of profiles (a) for classification and mapping and (b) for the collection of horizons samples for laboratory analysis.

(vi) The extraction of *continuous* soil monoliths from a selected pit face using a special wooden or steel container, and later the preservation of exhibition surfaces of the monoliths by applying specially prepared transparent fixative.

(vii) The extraction of *discontinuous* representative horizon sections using the frame sample technique and preservation method as for (vi).

(viii) The use of the lacquer-film method of extracting and preserving soil profiles.

(ix) The use of colour photography in recording soil profiles, or, alternatively, the use of monochrome photographs for subsequent hand colouring after checks have been made on the soil colours in the field.

(x) The ultimate recording in map form of field data (and subsequently derived laboratory data) referring to one or more soil characteristics or to soil types as such. Soil maps may be of generalized kind based on reconnaissance survey covering large areas, or alternatively may be very precise, derived from intensive survey using refined methods in a limited area.

(i) *Elementary field reconnaissance exercises* can be arranged by following Dokuchaiev's long-established principles (*vide* Clark[14]) regarding soil differentiation in the field. Writing in 1879, he recognized that every "dry land vegetative soil" resulted from the operation of the following factors:—

(a) the climate of the locality
(b) the nature of the parent material
(c) the mass and character of the vegetation
(d) the age of the country
(e) the relief of the locality

Further, if (a), (b), (c), (d) and (e) were similar in two places, the soils would be similar no matter how far apart the places. This interpretation is still entirely valid (assuming that (d), the time factor, includes the effect of man) and is registered in one form or another in all the subsequent miscellaneous soil classifications. For a given study area the relative significance of each of these five factors can be assessed in quite an elementary fashion in the first instance. Subsequently, particular factors can be examined in more detail, e.g. the relation of soil depth, drainage and profile to variations in the shape of the land surface. Elementary morphological mapping, as described by Waters,[15] can be of great assistance in helping pupils or students to appreciate the pattern of slopes and forms in a land surface, and where parent materials are constant in a given study area, the relation of land geometry to differences in soil profiles can be satisfyingly demonstrated. Furthermore, hill and valley soils, wold and vale soils each receive different

effective rainfalls, and, according to angle of slope, texture of soil and permeability of parent material simple observations can be made on the variations in level of water tables and on the amount and rate of movement of water in differently sited soils at different times of year, and logical explanations can be attempted of the degrees of impedance in evidence and on the depth or absence of gleyed horizons in particular profiles.

The advantages of aerial photographs, verticals in particular, in soil reconnaissance and survey have been expounded elsewhere.[16] Suffice it here to show the limitations of this technique in maturely developed agricultural districts of Britain. The accompanying photographs and map of part of a Cardiganshire farm (see Fig. 2 and appended notes) illustrate the point. Oblique aerial views or photographs taken from a suitable vantage point (as in Fig. 2 (b)) are helpful in showing links between land morphology and variations in soil type in this kind of landscape. It is, however, in the relatively virgin lands of the world and, though to a far less spectacular degree, the relatively unimproved parts of Highland Britain, where a semi-natural moorland flora prevails, that a vegetation pattern may be revealed on vertical aerial photographs which frequently reflects the soil pattern beneath it. For example, the fast-spreading bracken usually indicates a well-drained or moderately well-drained, brown earth; heather may be associated with hill peat or soils showing some degree of podzolization; cotton grass and deer grass suggest badly drained soils with gleyed horizons.

(ii) *Textural classifications* have been suggested by Clarke[17] and by Sankey.[18] Such tests as (a) whether the soil can be formed into a cohesive ball in the hand or not, (b) whether the soil cleans or dirties the fingers, or (c) what effects wet or dry weather spells have on the soil surface, will enable a more precise idea to be obtained of what is meant by a "clay soil" a "heavy loam" or a "light sand". Once the physical differences between the gravel, sand, silt and clay particles and the way they form different textures are understood, it is most helpful again to visualize the soil three-dimensionally not only in terms of its "architecture" but also in terms of its "pore space", viz. the maze of interconnected channels between the particle aggregates. In appreciating the seasonal fluctuation of water tables in relation to the staining and streaking of mottled layers in gley soils, the co-operation of the chemistry teacher should be sought. Nature offers an excellent illustration of the effects of oxidation processes under the aerated conditions of summer in alternation with the reduction processes under the water-logged conditions of winter. Again, the leaching of the sesquioxides in the podzolic profile, the resistance to leaching of calcareous soils (e.g. the chalk and limestone soils of the Lowland Zone or the Lias soils of the Vale of Glamorgan), the formation of iron pan in certain podzols are, for example, fundamental soil processes which, although demanding adequate explanation in chemical terms, are not thereby of any less significance to the geographer.

(iii) *Augers, corers and borers* of several kinds are available on the market, or they may be manufactured to required specification.[19] The simple T-shaped screw auger is the cheapest and most versatile tool for obtaining a *second-hand* (let it be stressed) impression of *vertical* sequences in the soil to depths of 3 or 4 feet. This is a stage beyond superficial inspection of surface soil conditions. The screw action of the insertion of the auger and the vigorous efforts frequently required to extract it must interfere with the natural structure and constitution of samples. Moreover, deeper samples are liable to contamination by remnants of shallow samples adhering to the sides of the hole imperfectly bored by the screw of the auger. The question arises in the field as to where and how frequently the auger should be used to determine soil distributions. Should a regular spacing of insertions be used to obtain a representative pattern, or should a change of slope or vegetation, for example, demand more intensive auger programmes in certain zones to identify and locate soil boundaries as precisely as possible? Ideally, a combination of the two policies should yield the most valid results. However, at best, the auger should be used to confirm rather than to identify *a priori* soil types and soil boundaries. Corers and borers (or gouge augers) enable continuous and relatively undisturbed, cylindrical columns of soil to be extracted, and are therefore superior to the simple auger. In the simplest of corers, only surface layers can be taken and the instrument can often come up infuriatingly empty in certain soils of loose consistency. The Velten soil sampler is a cylinder with a sharp edge at the base which enables a thick core of top soil and surface vegetation to be collected. Other cores may be taken successively at deeper levels if soil and parent materials are penetrable and adhere to the corer.

(iv) *Field tests for alkalinity or acidity* of soils are relatively easy. The B.D.H. Universal Soil Testing Indicator is cheap, quick and easy to handle and gives good estimates of pH values.[20] The method is simply to place a sample of soil untouched by hand (sweat may cause an acidic reaction) in the larger end of the small elongated container provided with the Indicator. The container must be clean and, if it is not possible to wash it, some of the soil to be tested should be rubbed over it. Add just enough Indicator to immerse the soil sample completely; then after about a minute, when the reaction has taken place, tilt the container slightly to separate the solution from the sample. Diagnose the colour of the solution and estimate the pH of the sample according to a recognized colour chart or to the following table.[21]

| *Colour* | *Reaction* | *Colour* | *Reaction* |
|---|---|---|---|
| Deep red | Extremely acid | Yellowish–green | Neutral |
| Red | Very acid | Blue | Alkaline |
| Orange | Moderately acid | Deep blue | Very alkaline |
| Yellow | Slightly acid | | |

Alternatively, but more expensively, pH values correct to the nearest tenth can be estimated in the field by using a portable pH meter. The

soil sample is placed in a suitable receptacle and saturated with distilled water; then the two electrodes of the meter are immersed in the solution and the pH read off the recording meter.

The application of a little diluted hydrochloric acid (one part HCl to one part $H_2O$, transportable in a small bottle) will indicate the amount of carbonates present in a given soil sample in the field. Clarke quotes[22] as below:

| *% Carbonates ($CaCo_3$) present* | *Audible effects of reaction* | *Visible effects of reaction* |
|---|---|---|
| 0·1 | None | None |
| 0·5 | Faintly audible increasing to slightly | None |
| 1·0 | Faintly audible increasing to moderate | Slight effervescence |
| 2·0 | Moderate to distinct; heard away from ear | Slightly more general effervescence |
| 5·0 | Easily audible | Moderate effervescence Bubbles to 3 mm. easily visible |
| 10·0 | Easily audible | General strong effervescence Bubbles to 7 mm. easily visible |

The only satisfactory way *to identify soil colours* accurately is in the field. So many colour films are suspect on the reproduction of one or more colours that first hand comparisons in the field using recognized colour classifications already referred to on p. 59 are essential.

(v), (vi) and (vii) *Soil pits, monolith extraction and preservation.* Undoubtedly, the most profitable way of studying soil in the field is the most laborious, viz. by digging a soil pit, from the walls of which natural (continuous or discontinuous) monoliths can be taken and transferred to special containers. Several detailed descriptions[23] are available of methods of digging soil pits, and of extracting monoliths therefrom and of the types of monolith containers that may be used.[24] The soil pit (Fig. 3 (a)) should open towards a southerly point of the compass to enable good light to be available for photographing the northern "exhibition" wall of the pit. The entrance to the pit may be conveniently stepped for ease of digging in the first place, and for accessibility and manœuvrability at later stages. The north wall and flanking east and west walls of the pit should be as near vertical as possible, and, if anything, slightly over-hanging, especially the wall selected for monolith extraction. In Fig. 3 the insertion of a large monolith container (with or without base) into specially cut slots is demonstrated. The next stage is to guillotine the monolith, assuming steel containers with steel lids are being used. It is not always possible to do this, especially in very stony soils. In such an event or should only wooden containers be used, it is necessary to dig carefully round the sides and, later, the back of the monolith enabling the extraction of the monolith in enlarged, protruding form (see Fig. 3 and notes). Experience will show that the final severing of the monolith from the wall, after the container has been pushed well home, is difficult if the

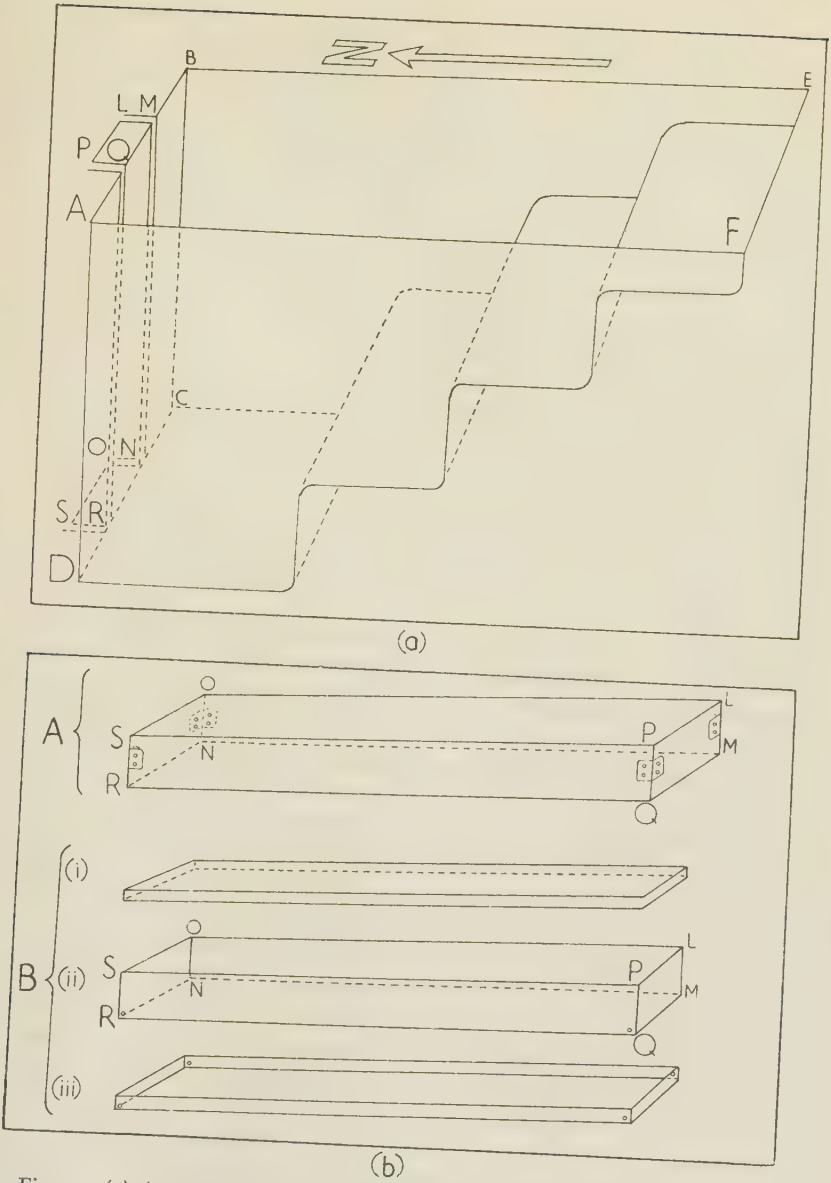



Fig. 3.—(a) A soil pit and (b) a soil monolith container.

Note: In the upper diagram, **ABCD** is the south-facing exhibition wall of the soil pit into which steps descend from the southern end at **EF**. For the extraction of the monolith, the frame (B(ii) in lower diagram) is inserted into specially cut slots **LMNO** and **PQRS**. When the frame is fully inserted, its base (B(iii)) is screwed on. The lid (B(i)) is pushed down vertically into position through **LP** (in upper diagram), thus severing the monolith from the face of the pit. The lid may have a flange at both ends or it may be used simply as a guillotine. This method of extraction is most successful with steel frames. Alternatively, and ideally with wooden frames, a lidless box (A in lower diagram), with base already attached, is placed fully into the slots **LMNO** and **PQRS**, the flanking walls then being dug through (**AQRD** and **MBCN**) until the monolith can be removed. This allows the extraction of a larger monolith, protruding above the level of the container when placed horizontal. Thus many samples may be taken and fresh faces cut before the monolith is flush with the top of the frame, at which stage the final face can be treated to preserve its texture and colour, a process which gives the best results when the time lag between extraction and treatment is short.

wall is leaning outwards, however slightly, from the pit. Steel containers are more easily inserted and more adaptable and durable than wooden ones but the latter are cheaper and have proved reasonably satisfactory. Secure steel lids or steadying hands are essential, particularly during the transport of monoliths which can be ruined by a rough ride on hilly tracks. Prior to applying transparent fixative the exhibition surface of the monolith should be cleaned carefully. A big, sharp knife is useful for this purpose and, to avoid contamination of horizons, strokes *along*, i.e. side to side, and not *across*, i.e. up and down, the face of the monolith are advisable. Similarly when cleaning a soil profile exposure with a knife in the field for exhibition purposes it is wise to work along the horizons laterally rather than across them downwards.

Unprotected surfaces of monoliths dry out and lose their natural colours and structure. Bascombe's method[25] of preserving soil monoliths is as follows.

*Solutions required:*

| | |
|---|---|
| Solution A | 8% Vinylite Resin in acetone |
| Solution B | 8% Vinylite Resin in methyl iso-butyl ketone. |
| Solution C | Mixture of 1 part solution B with 2 parts solution A. |

(Vinylite Resin (VIHH) is obtainable from Messrs. Bakelite Ltd., Aycliffe Works, Co. Durham. Automatic shakers are required to enable the resin to be dissolved completely in the acetone (Solution A) and the ketone (Solution B). Solutions A and C are used directly in the stabilization process; Solution B is used only to prepare Solution C.) The monolith is maintained in a damp condition until the required cleaning of the surface has been completed; it is then treated with Solution A applied gently as a fine jet from a wash bottle. This is allowed to penetrate and further applications are made until the soil appears to be well impregnated. The surface is then allowed to dry; it will probably take on a whitish colouring. Solution C is then applied in a similar manner, one application usually being sufficient. The surface should dry to the natural moist colour of the soil. If on drying the surface is at all shiny in places this can be reduced by application of a small quantity of pure methyl iso-butyl ketone to dissolve the excess of resin present.

The best soil monoliths for teaching purposes are continuous representations of the soil profile, which are inevitably large and heavy to carry and take up much storage space. Small, discontinuous monoliths obtained by using sample-frames[26] are light in weight and easy to transport and store, but their discontinuity is not in keeping with the ideals of study of the soil in the field as a three-dimensional and continuous medium. The type of monolith container recommended by Perrin[27] is an attempt to overcome the disadvantages of very large and very small monoliths, but it exaggerates, unfortunately, the universal defect of all monoliths, the lack of lateral extent and representation of soil horizons.

(viii) *Lacquer-film method.* More spectacular, and providing lateral as well as vertical representation of the soil profile, is the lacquer-film method devised by Voigt.[28] A soil pit or similar access to a vertical soil exposure is first needed. A relatively dry face is selected and an area marked out as required with large nails and string. The area chosen is then smoothed and cleaned with spade, knife and brush, care being taken not to contaminate adjacent horizons. When the face is as dry as possible, a preliminary application of diluted lacquer (a mixture of one part lacquer to four parts acetone is recommended) is spread evenly on the exposure, preferably with a spray gun. (Voigt recommends *Spezial Präparations-Lack Z* 4/924, a lacquer produced by G. Ruth, Temperol-Werke, Hamburg-Wandesbek 1, Walddörferstrasse, although any highly viscous, cellulose lacquer may be tried.) The diluted lacquer fills the pore space to a depth of $\frac{1}{8}$ inch or so, and as the solvent (i.e. the acetone) evaporates, the soil particles are cemented together to this depth. After this superficial consolidation of the face, it can, when dry, be painted evenly with thick coats of lacquer, using a broad, flat, not too soft brush. The number of coats required may vary from two to five; very porous materials, e.g. coarse sands, absorb more lacquer than less porous materials, e.g. heavy clays; again, profiles containing large stones will require more coats than those which are stone-free. In between earlier and later applications of lacquer, strips of webbing or canvas may be inserted; this is optional, however. Eventually, a profile of the marked-out area can be peeled off, using a knife where necessary. It will vary in thickness, between perhaps $\frac{1}{4}$ inch and $\frac{1}{2}$ inch, according to the type of soil and the degree of lacquering. It can be rolled up, exhibition side on the outside (i.e. lacquered side on the inside) like a carpet, if not too stony, and being light in weight is easily transported. It may be suspended from a wall like a tapestry or mounted for exhibition on a plywood frame. The lacquered side constitutes a durable, flexible base; the "display" side presents a natural soil profile with every particle in its natural position. To preserve colours and appearance of lacquered profiles, a variant of Bascombe's method may be used. The unique advantages of the lacquer method are in the relatively unlimited lateral extent of the sample, and its light weight per unit size. Monoliths are quite narrow bodies of soil, and colour photographs showing lateral disposition of horizons represented in the monoliths should always be regarded as essential. A combination of horizontal and vertical lacquered profiles or casts can be used to make three-dimensional lacquered soil blocks representing actual soil bodies and providing invaluable teaching equipment.[29]

(ix) *Colour photographs.* It is usually difficult to achieve true reproduction of natural soil colours. Fitzpatrick[30] has recently shown the advantage of hand-tinting monochrome enlargements by making reference to the Munsell Soil Color Charts in the field and at the site.

He advocates the taking of a colour photograph for reference during hand-tinting as well as for record purposes, but for simple profiles one can achieve his object without a colour photograph. Hand-painted photographs of soil profiles produced in this way survive much longer than the large type of monolith, especially if its surface has been untreated.

(x) *Soil maps.* Finally, the end product of all these methods, the soil map itself, can at best have boundaries and labels which are a true reflection of conditions on and in the ground and, at worst, give a very simplified idea of the general distribution of soil types over a large area. It is clear, as with all types of maps, that scale is a very vital consideration. The fundamental fallacy of the linear boundary which threads through all geographical analysis and interpretations could not be better demonstrated than by searching out a soil boundary in the field. Indeed, perhaps the only satisfactory kind of soil map is one which shows gradations in particular soil properties between known, observed and located extremes rather than one which parades the alleged unities of "soil types" which can at most be a pale reflection of the variety of profiles awaiting individual inspection in the field.

REFERENCES


[1] Sir E. J. Russell, *Lessons on Soil*, Cambridge, 1950 (first edition 1911).

[2] V. V. Dokuchaiev, *Russian Soil Survey* (in Russian), 1879, quoted in the following works: K. D. Glinka, *Die Typen der Bodenbildung*, Berlin, 1914, pp. 21–2; J. S. Joffe, *Pedology*, New Brunswick, N.J., 1949, pp. 17–19 (first edition 1936).

[3] Sir R. I. Murchison, Director General, Geological Survey of Gt. Britain 1855–71; *vide* Sir A. Geikie, *Life of Sir Roderick I. Murchison*, 2 vols. 1875.

[4] G. W. Robinson (and others), *Soil Survey of Wales: Progress Reports*, *Welsh Journal of Agriculture*, vol. 4, 1928, pp. 303–21; vol. 6, 1930, pp. 249–65; vol. 8, 1932, pp. 197–213; vol. 11, 1935, pp. 188–208; vol. 15, 1939, pp. 272–301.

[5] Sir D. Hall, *The Soil*, London, 1903 (revised edition by G. W. Robinson 1944).

[6] R. Glentworth, *The Soils of the Country round Banff, Huntley and Turriff*, Mem. Soil Survey of Great Britain, H.M.S.O., London, 1954, p. 37.

[7] J. A. Taylor, *Wales: a Physical, Historical and Regional Geography*, ed. E. G. Bowen, Ch. III, *Soils and Vegetation*, pp. 95–127, London, 1957.

[8] H. C. K. Henderson and E. C. F. Bird, "An excursion to the Central Weald", *Geography*, vol. xliii, 1958, pp. 18–30, particularly Fig. 3, p. 25.

[9] B. W. Avery, "A sequence of beechwood soils on the Chiltern Hills, England", *J. Soil Science*, vol. 9, 1958, pp. 210–24.

[10] V. V. Dokuchaiev, *op. cit.*

[11] G. R. Clarke, *Study of the Soil in the Field*, London, 1957, pp. 136–67 (first edition 1936).

[12] R. S. Waters, "Morphological mapping", *Geography*, vol. xliii, 1958, pp. 10–17.

[13] Munsell Soil Color Charts, specifically for the use of soil scientists, etc., Munsell Color Company, Inc., Baltimore 2, Maryland, U.S.A.

[14] *vide* G. R. Clarke, *op. cit.* pp. 13–14.

[15] R. S. Waters, *op. cit.*

[16] G. R. Clarke, *op. cit.*

[17] *vide* G. R. Clarke, *op. cit.* pp. 168–202.

[18] J. H. P. Sankey, *A Guide to Field Biology*, London, 1958, pp. 18–22, 118.

[19] Cornelius Whitehouse and Son Ltd., Cannock Edge Tool Works, Cannock, Staffs. manufacture soil augers etc. to specification at about £1. See also G. R. Clarke, *op. cit.* pp. 123–26.

[20] B.D.H. Universal Soil Testing Indicator, supplied by British Drug Houses Ltd., is available from most chemists.

[21] J. H. P. Sankey, *op. cit.* pp. 15–16, 116–17.

[22] G. R. Clarke, *op. cit.* pp. 114–16.

[23] G. R. Clarke, *op. cit.* pp. 49–52, 117–23; also W. L. Kubiëna, *The Soils of Europe*, London, 1953, pp. 277–86.

[24] R. M. S. Perrin, "A simple monolith container", *J. Soil Science*, vol. 8, 1957, pp. 158–60.

[25] W. Bascombe, Rothamsted Experimental Station, Harpenden, Herts., has modified the method invented by J. J. Schuurman—*vide* "Een nieuwe methode voor het Conserveren van Bodemprofielen", Overdrukken *T.N.O.-Nieuws*, Sept. 1949.
[26] W. L. Kubiëna, *op. cit.*
[27] R. M. S. Perrin, *op. cit.*
[28] E. Voigt, "Die Anwendung der Lackfilm-Methode bei der Bergung geologischer und bodenkundlicher Profile", *Mitt. Geol. Staatsinstitut. Hamburg*, vol. 19, Dec. 1949, pp. 111–29.
[29] E. Voigt, "Der Block-Lackfilm", *Zeitschr. deutsch. geol. Ges.*, vol. 99, 1947, pp. 124–31
[30] E. A. Fitzpatrick, "Coloured photographs of soil profiles", *J. Soil Science*, vol. 7, 1956, pp. 65–7.

# APPENDIX

## AVAILABILITY OF DRIFT MAPS AND SOIL SURVEY MAPS IN THE BRITISH ISLES

### DRIFT MAPS

*One-inch scale.* The availability of Old Series One-inch drift maps (see inset map of England and Wales, Fig. 1) and of a number of New Series One-inch sheets, both for consultation only, compensates to some degree for the incomplete coverage of New Series One-inch sheets available for purchase. North of a line approximately from Blackpool to Hull, Old Series One-inch sheets correspond in position and extent with New Series sheets; south of this line, there is no correspondence at all. The Isle of Man sheet (Old Series) is available for consultation as a separate.

*Six-inch scale.* Most Six-inch drift sheets remain purely in manuscript form and have never been published. For most of the coalfield areas of England, Wales and Scotland and for the London area specifically Six-inch drift sheets have been published; of these, most pre-war sheets are for consultation only and are not available for purchase, but most of the post-war sheets are available for purchase. The format of the coalfield maps is black and white; the Ordnance Survey will provide hand-coloured maps on request. The London area maps are colour-printed. For most of England north of a line from Blackpool to Hull, much of central and southern England, and south Wales, Six-inch drift sheets are available only for consultation; photographic copies are available on request from the Geological Survey. For Ireland, Six-inch coverage is complete, but, as with the One-inch drift information, superficial deposits are merely marked on the maps of solid geology and are rarely differentiated into types of drift, e.g. boulder clay, sands and gravels. A few of the Six-inch sheets showing this information for Ireland have been published but the majority are available for consultation only.

*Quarter-inch scale.* Drift maps are available for east and southeast England only; of these only sheet no. 12 has been available for purchase, the remainder being available for consultation only.

The drift surveys of coastal areas of Northern Ireland are primarily of a reconnaissance nature.

Fig. 1 has been compiled from the following sources:

England, Wales and Scotland: The Director, The Geological Survey and Museum, Exhibition Road, South Kensington, London S.W.7.

Northern Ireland: Professor of Geography, Department of Geography, The Queen's University, Belfast.

Eire: The Director, Department of Industry and Commerce, The Geological Survey of Ireland, 14 Hume Street, Dublin.

Maps noted as "available for consultation" may be consulted on application at these addresses.

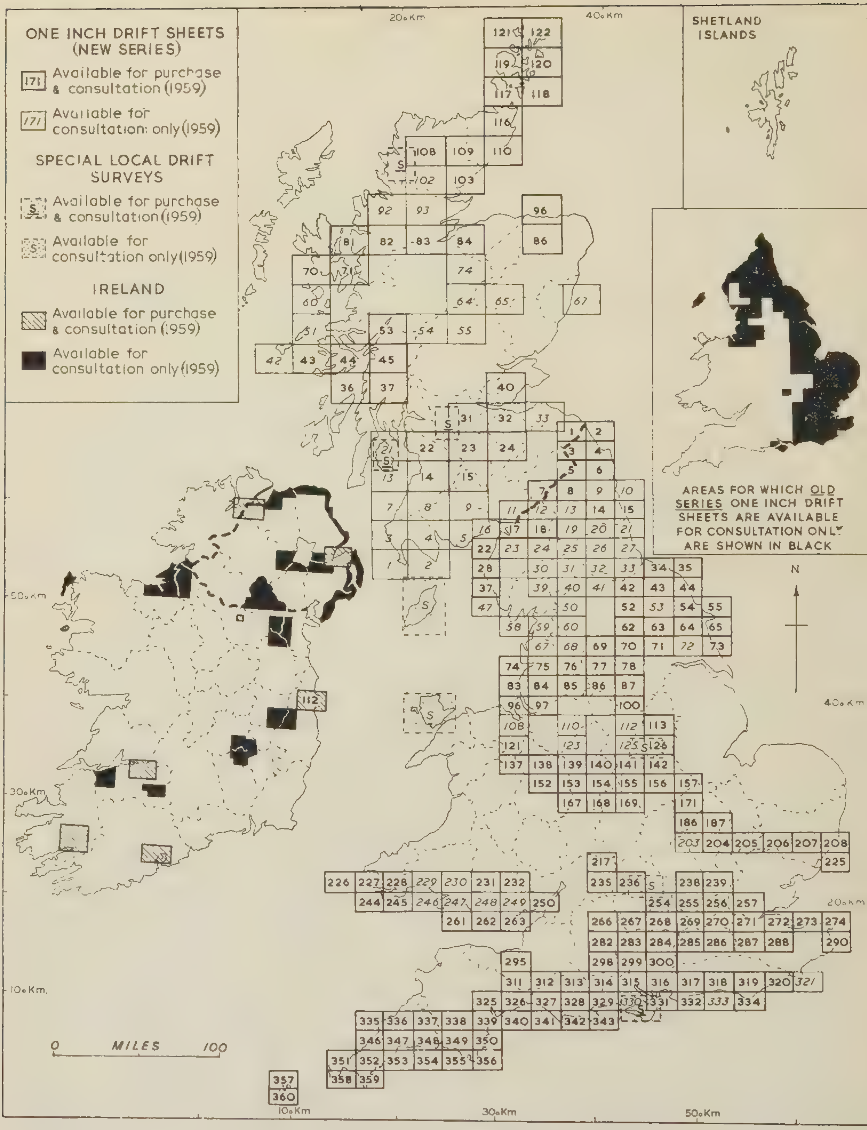



Fig. 1.—Availability of One-inch Drift Maps of the British Isles for purchase and for consultation, up to 1959.

## SOIL SURVEY MAPS

Even the addition of *ad hoc* surveys to the data in Fig. 2 fails to disguise the general incompleteness of the soil survey coverage to date. The Soil Survey of England and Wales has recently introduced a new programme of reconnaissance soils mapping which is designed to cover those countries in twenty years. For the areas for which One-inch soil surveys have been published, Six-inch or, in some cases, 1 : 25,000, field sheets are available, for consultation only, at Aberdeen, Rothamsted, Belfast or Dublin (addresses below).

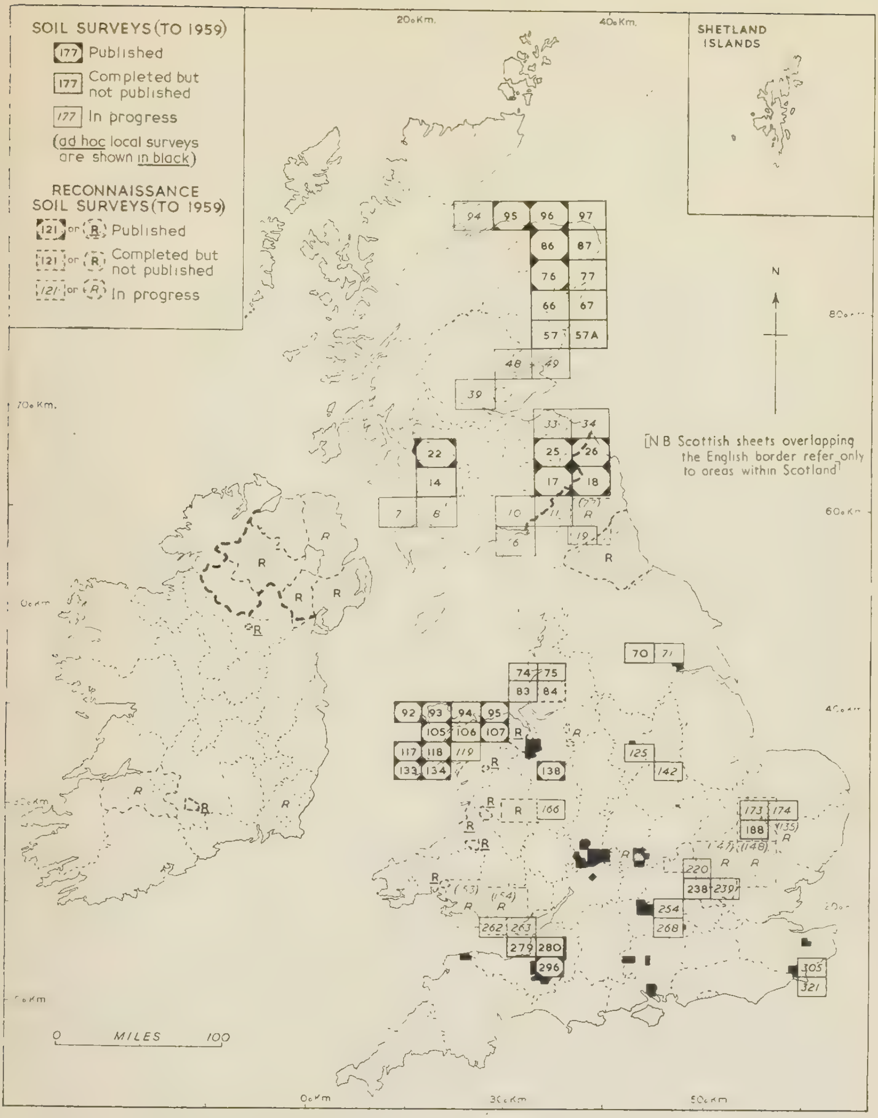



Fig. 2.—Availability of One-inch Soil Survey Maps of the British Isles up to 1959.

Fig. 2 has been compiled from information supplied by the following sources:

England and Wales: The Director, Soil Survey of England and Wales, Rothamsted Experimental Station, Harpenden, Herts.

Scotland: The Director, Soil Survey of Scotland, The Macaulay Institute for Soil Research, Craigiebuckler, Aberdeen.

Northern Ireland: The Professor of Geography, Department of Geography, The Queen's University, Belfast.

Eire: The Director, Department of Industry and Commerce, The Geological Survey of Ireland, 14 Hume Street, Dublin.

The kind co-operation of the officers in the various institutions mentioned in this appendix is gratefully acknowledged.

# Yafele's Kraal

## A Sample Study of African Agriculture in Southern Rhodesia

J. H. BECK

A CONSEQUENCE of the rapid industrialization of Southern Rhodesia is the drift of the Africans to the towns to seek employment. Nevertheless the majority of Africans still depend for their livelihood on agriculture, much of which, despite great progress by Government officials in their efforts to improve the standard, remains at subsistence level. Producing little cash surplus, it can do little to attract the men of African society away from the remuneration of industrial employment.

One of the foremost problems of Southern Rhodesia, as of most African territories, is to establish for the African a system of farming which will satisfy the growing food demands of the increasing urban African population, which will conserve the land against the ravages of primitive agriculture and of soil deterioration due to heavy rainstorms and high temperatures, and which will provide for the African a cash income to purchase the amenities and possessions which the Europeans around him enjoy and to pay for the education of his children. To this end, the Southern Rhodesian Government enacted in 1951 the Native Land Husbandry Act which was to revolutionize the whole system of African agriculture in the hope of stabilizing the African farming community and of affording it a standard of living equal to that of the urban African. Sir Patrick Fletcher, C.M.G., M.P., the then Minister of Native Affairs, said of the Act:

> "Land problems are the root of the greatest failures and miseries of this continent. Grave problems flow from crowded and stagnant communities scraping a bare existence from the exhausted countryside and spilling as an inefficient labour force into industrial centres many miles from their homes and families.
>
> "The Scheme, dealing as it does with 31,000,000 acres (47,000 square miles) at a cost of seven million pounds, of which four million pounds is being contributed by the native farmer, is unique and probably one of the most extensive of its kind ever attempted in Africa."[1]

By 1960, all the Native Reserves of the country will have been placed under the provisions of the Act and the following description of Yafele's Kraal will be typical of all African farming, with the exception of the

➤ Mr. Beck is headmaster of the Dangare Government Primary School, Umtali, in the African Education Department. The survey of 24 villages from which this sample study is drawn was presented in 1957 for a M.A. degree at London University, while the author was senior geography master at Goromonzi Secondary School.

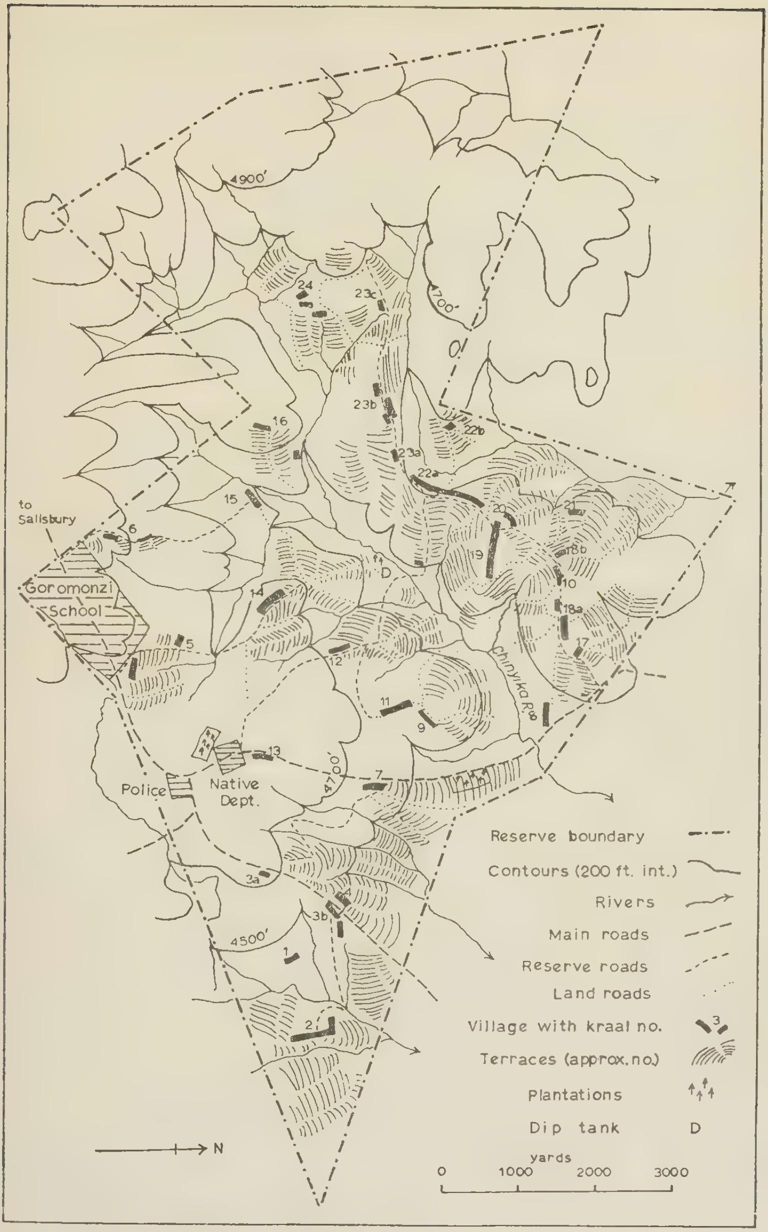



Fig. 1.—Chinyika Reserve, Southern Rhodesia. Village no. 5 is Yafele's kraal. "Land roads" are tracks between villages and farm lands.

African-owned purchase-farms, which are larger units of 150–300 acres owned by the farmer and supporting a true cash economy.

Under the Land Apportionment Act, the land of Southern Rhodesia is broadly divided into European and African areas, the latter being divisible into Reserves and Native Purchase Areas. The majority of

African farmers live in the reserves of which there are 96. One of the smallest of these is Chinyika Reserve, 25 miles east of Salisbury, the capital of Southern Rhodesia, lying between the road from Salisbury to Umtali and that from Salisbury to Blantyre, Nyasaland, via Tete on the Zambesi River. Within the 12,608 acres of Chinyika Reserve there are 24 villages or kraals with a total population of 1600 people, of whom only 59 were in 1955 resident adult males. Yafele's kraal (No. 5 in Fig. 1) lies on the southern edge of Chinyika Reserve and is more fortunate than most villages in the reserve, in that it is situated by a main road connecting Salisbury to the Native Commissioner's Office, two miles northeast of the kraal. The other kraals are connected to the main road by reserve roads of a type similar to an English farm track.

The Native Commissioner is responsible for the administration of the reserve and the agriculture of the whole reserve is under the supervision of an African demonstrator, himself responsible to the Land Development Officer. It is the demonstrator's duty to pay numerous visits to kraals in the course of the year, to advise on house-building, contour ridging and crop rotations, and to ensure as far as possible that the standards of farming and soil conservation laid down by the Department of Native Agriculture are maintained.

A Land Husbandry Register is maintained by the Native Commissioner, in which each village, and each family in the village, has a number. Thus Yafele's Kraal is village No. 5; and in it there are thirteen families:

| | |
|---|---|
| 1. Nawu | Works at Salisbury Post Office and returns to the village every week-end; one wife; four boys; two girls. |
| 2. Tambudze | Storekeeper ten miles from the kraal, outside the reserve; returns to the village at week-ends; one wife; three girls; owns one plough and one cart. |
| 3. Chingaidoze | Widow. |
| 4. Timothy | A driver in Salisbury, home at week-ends; one wife; three boys; three girls. |
| 5. William | A Kraal Headman; works at Goromonzi School one mile from village; one wife; three boys, two of whom are 6. Timothy, and 7. Aaron. Owns one plough, one cultivator. |
| 6. Timothy | Works at a Police Camp one mile east of village, returning home at night; one wife; two boys; one girl. |
| 7. Aaron | Works in Salisbury, home at week-ends; one wife; one boy; two girls. |
| 8. Machingura | Works at Goromonzi School, home at night; one wife; three boys; five girls; owns a plough. |

| | |
|---|---|
| 9. Jim | Works at Goromonzi School, home at night; one wife; ten boys; eight girls; owns one plough. |
| 10. Zwichawaya | Storekeeper 10 miles from village outside the reserve; home at week-ends; one wife; four boys; one girl; owns one plough. |
| 11. Mpewina | Widow; owns a plough. |
| 12. Maruki | Storekeeper 15 miles from village outside the reserve; home at week-ends; one wife; one boy; five girls. |
| 13. Zwiyozwamambo | Lives permanently in Salisbury while his children, lands and cattle are cared for by his mother—11. Mpewina. |

From this list it will be seen that all but four of the males have employment outside the reserve in order to earn the cash that their own farming fails to supply. On account of the proximity of a large school and a police camp, the four men who work locally can reside in the village at night and assist with the farming. In all reserves something like 90 per cent of the males are absent in the larger towns, returning only after long intervals so that the farming becomes the work of the women.

The village is divided into Sections A and B (Figs. 2 and 3), ¾ mile apart, the arable area lying between them. The Land Development Officer sites the village line along the highest land, very often on a ridge, and the lands (the cultivated area) are located on the slopes below the village.

There are three types of huts: the living room and bedroom; the kitchen; and the grain store (Plate I). Corresponding to these three types, there are normally three lines of huts (in Fig. 3 the three lines are better developed in Section B than in Section A). Originally the Africans dwelt in circular huts of pole and dagga (that is, vertical poles covered with clay) but, as a result of the teaching of the African demonstrator, all huts are now brick with thatch or asbestos roof, and only one hut, No. 7, recalls the original pattern, the others having adopted the rectangular European style. Other features of European origin are the introduction of windows, the plastering and painting of the brick, the division of the hut into bedroom and sitting room, and the prevalence of tables, chairs and beds.

In the kitchen line, circular huts still predominate and their design has changed little. They have no windows or outlet for the smoke, except by percolation through the thatch. In the centre of the floor there are two brick supports, with a grill of iron bars for supporting the pots between them, and round the wall a ledge for seating. In some cases, farmers 3, 4, 5, 9, 10, the family has two kitchens.

The grain huts form the third line and, as in Section B, are normally on the far side of the kitchen from the living huts. These huts are round,

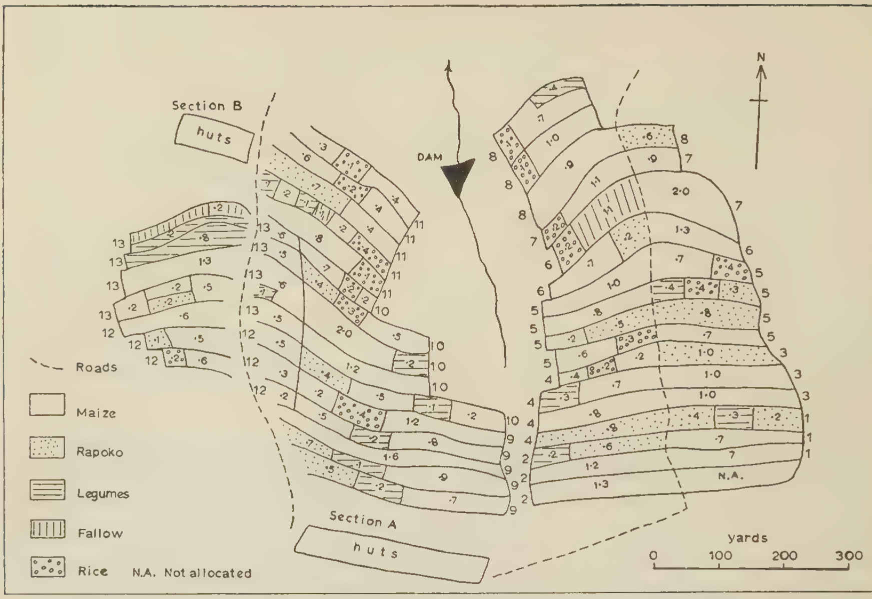



Fig. 2.—Yafele's kraal: crops 1954-5. Acreages of crops are shown in terraces which are numbered to indicate ownership. Note that these acreages do not entirely agree with actual areas of terraces.

they are lower and smaller than the kitchen huts. Their distinctive feature is that they are raised off the ground on large granite stones as a measure of protection against damp and ants. In these huts the stocks of grain and pumpkins are stored for the year's food supply.

Fig. 2 shows the lands for Yafele's kraal with the crops for the season October 1954 to March 1955. The area is divided into strips called "terraces", which are separated by contour ridges. The terraces retain their natural slope and the ridges the natural vegetation, savanna grass. On the higher side of the ridge a ditch is dug, the ditch and ridge forming an adequate barrier against excessive run-off and consequent soil erosion. The terrace width varies according to the slope of the land, but the average width is approximately twenty yards. To each family permanent strips are allocated and recorded on base maps at the Native Commissioner's Office. Assuming there is sufficient land available in the reserve, each family, according to the Act, should receive approximately six acres, the amount being increased for headmen and men with more than one wife and reduced for widows with no family responsibilities. Table 1 shows the total acreage for each family in Yafele's kraal.

On an average the acreages are well below the standard six acres. While the allocation of specific blocks of land to individuals is a new development in contrast to the custom of communal tenure, the farmer does not own the land, but possesses only the right to farm it. This

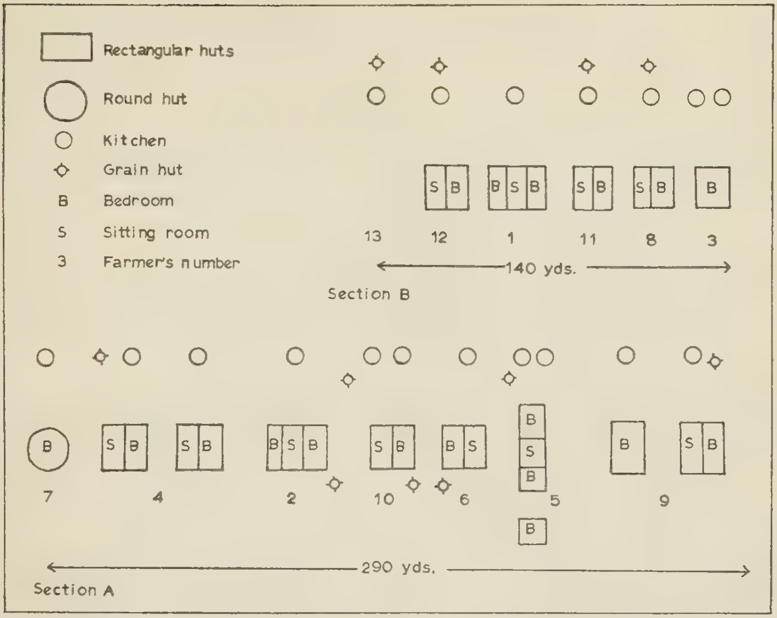



Fig. 3.—Yafele's kraal. General layout of huts in sections A and B.

*Table I*

YAFELE'S KRAAL

*Acreages by Farms of Individual Crops:* 1954–55 *Season*

| *Farmer* | *Fallow* | *Maize* | *Rapoko* | *Legume* | *Rice* | *Total Acreage* |
|---|---|---|---|---|---|---|
| 1 | — | 1·4 | 0·6 | 0·3 | — | 2·3 |
| 2 | — | 2·5 | 0·6 | 0·2 | — | 3·3 |
| 3 | — | 2·0 | 1·0 | — | — | 3·0 |
| 4 | — | 2·1 | 0·8 | 0·3 | 0·2 | 3·4 |
| 5 | — | 4·0 | 1·6 | 0·4 | 1·1 | 7·1 |
| 6 | 1·1 | 2·0 | 0·2 | — | 0·2 | 3·5 |
| 7 | — | 4·0 | — | — | 0·2 | 4·2 |
| 8 | — | 2·6 | 0·6 | 0·4 | 0·2 | 3·8 |
| 9 | — | 5·9 | 1·2 | 0·5 | 0·4 | 8·0 |
| 10 | — | 5·3 | 0·8 | 0.3 | 0·5 | 6·9 |
| 11 | 0·1 | 3·3 | 0·7 | 0·2 | 0·8 | 5·1 |
| 12 | — | 2·7 | 0·1 | — | 0·2 | 3·0 |
| 13 | 0·2 | 4·4 | 0·2 | 1·1 | — | 5·9 |
| | 1·4 | 42·2 | 8·4 | 3·7 | 3·8 | 59.5 |

right may be sold to another African, subject to the approval of the Native Commissioner, providing the purchaser does not acquire more than three times the standard area of approximately six acres.

Summer in Southern Rhodesia is from October to March during which season approximately 35 inches of rain fall, most of it in heavy thunderstorms with falls of as much as one inch in one hour. In September the manure and compost accumulated during the winter are carried to the fields and the land ploughed in preparation for the sowing. Sowing commences normally in the middle of November, but

will also depend on the promise of the rains. Maize (*zea mays*), rapoko (*eleusine coracan*) and nyimo or groundnuts (*arachis hypogaea*), the last two being leguminous, are the main crops. There are slight differences in the length of the growing seasons of these plants; they are planted in the order maize, rapoko and groundnuts or nyimo, and are then harvested in the reverse order. Maize seeds are planted in holes, made with the hoe, three feet apart along the rows, which are also three feet apart. Groundnuts and nyimo are planted in a similar way. Rapoko is sown broadcast on the ploughed land which is harrowed with branches dragged over it by cattle. This crop is also known as finger millet as the grain occurs on five short stalks shooting from the head of the stem. Rice, an upland variety, is planted only where the soil is too waterlogged for other crops.

Other foods widely grown are varieties of the water melon and pumpkin families. These are grown on the mealie lands (i.e., the maize fields) and trail over the ground between the mealie plants. They are eaten with the basic maize foods.

Planting is essentially the work of the women and children; as school lasts from 7 a.m. to 1 p.m. the latter are free in the afternoons. During the long summer holidays (Christmas) the women and children make frequent visits to the farm lands to hoe and to weed.

The villagers harvest the groundnuts first in March and store them in 200 lb. bags in the grain huts, shelling them as required during the winter season. The nuts required for immediate use are frequently shelled on the lands, spread over the ground in circular patches surrounded by the haulms and then collected when sufficiently dry for use. They may be eaten as nuts or ground between two granite stones to make peanut butter.

The heads of rapoko are hand-picked and carried to the drying ground, a small area of granite outcrop, where they are spread on the rock surface and beaten with sticks to release the grain. After drying, the grain is stored in the village grain huts. When required, the grain is pounded with a pestle in a mortar to remove the husk, and is finally milled between granite stones. The main use of rapoko is in brewing beer, though it may be used for porridge if the maize harvest has been poor and a supplementary cereal is required. Maize, the staple food of the people, is harvested last. The cobs are picked by hand and carried to the kraals. To dry the grain, cone-shaped structures open at the top are built about 9 ft. high and 6 ft. in diameter at the top; they are constructed of branches joined at the base and diverging upwards to form the cone, and the inside is thatched with grass (Plate II). Either the cobs are placed in the cone and the grains dried on the cob, or the grains are stripped first and then placed in the cone for drying. The grain is kept in the cone open to the sun until it is ground. Rice is harvested in a similar fashion to rapoko but is eaten as a grain, being regarded by the African as a delicacy. After harvesting much of the

straw is left on the lands to be ploughed in during the winter ploughing. The mealie stalks are gathered and stooked, and later removed for compost or for feeding to cattle.

An assessment of yields is very difficult and many of the returns given by the farmers to the demonstrator must be suspect. Returns are made in "200 lb. bags" and "4 gallon paraffin tins", 6 paraffin tins being equal to a 200 lb. bag. Table 2 shows the yields for Yafele's kraal for 1954–55.

*Table II*

YIELDS OF MAIZE, RAPOKO, LEGUME FOR YAFELE'S KRAAL 1954–55
(In 200 lb. Bags and Paraffin Tins)

| *Farmer* | *Maize* bags | *Maize* tins | *Rapoko* bags | *Rapoko* tins | *Legume* bags | *Legume* tins |
|---|---|---|---|---|---|---|
| 1 | 1½ | | | 1 | 2 | |
| 2 | 1½ | | ½ | | — | |
| 3 | | 1 | — | | | 1 |
| 4 | 1 | | ½ | | | 1 |
| 5 | 3 | | ½ | | 1½ | |
| 6 | 2 | | — | | — | |
| 7 | | 1 | — | | — | |
| 8 | 2 | | 1½ | | 1 | |
| 9 | 2 | | ½ | | 1 | 1 |
| 10 | 2½ | | — | | ½ | |
| 11 | 1½ | | 1 | | — | |
| 12 | 1 | | 1 | | — | |
| 13 | 2 | | ½ | | ½ | |
| | 20 | 2 | 6 | 1 | 6½ | 3 |

By comparison with Table I examples can be seen of several farmers who grew rapoko but made no production return (Nos. 3, 6, 10), possibly because the acreage was so low that production was not considered worth reporting. Similar cases in the legume column are farmers 2 and 11. The yield per acre for each crop for the kraal can be assessed by combining the total figures for Table I and Table II. With maize, their staple food and, therefore, the most important crop of the three, on 42·2 acres the farmers produced 20 bags 2 tins, a yield of approximately ½ bag to an acre. The average for the whole reserve was 0·75 bags per acre and for European-run farms 5·4 bags per acre. Even though one takes into account the unreliability of the production figures, the yield figures for the village still show the very low standard of the farming.

Not all people in Yafele's kraal are permitted to own cattle. Since some Africans still largely measure wealth by the number of cattle they possess overstocking and overgrazing are problems. To combat this, the Native Commissioner assesses the number of cattle that the reserve can carry and allocates so many head of cattle to the people who wish to own cattle, the number being known as the authorized holding. In Yafele's kraal the authorized holdings are as follows:

| | |
|---|---|
| No. 1, 6 | No. 10, 4 |
| No. 5, 9 | No. 11, 4 |
| No. 8, 2 | No. 12, 6 |
| No. 9, 5 | No. 13, 4 |

Families not listed are not entitled to own cattle. Although the cattle are owned individually they are managed largely on a communal basis. Near the kraal each owner has an individual timber-built cattle kraal in which the cattle are kept at night (Plate III). In the morning all the animals from the village are herded together and taken to the pasture area for grazing, either by a child, if the schools are on holiday, or by one of the women during school terms. Though the farmers naturally tend to use areas nearest their particular kraals and regard them as their own, there are no definite pastoral areas assigned to each kraal. During the growing season the animals are carefully herded to prevent destruction of crops, but during the winter months they are allowed to graze anywhere, more frequently being found on the terraces grazing the crop residues. No special grasses are planted for cattle, the animals merely grazing the natural savanna grass, and no provision is made for winter fodder so that the cattle deteriorate markedly during the winter.

Once a week one of the villagers takes all the cattle to the dip tank, three miles distant in the centre of the reserve, where they are totally immersed in insecticide to prevent tick-borne diseases. It is at the dip tank that an official check is made of the individual's cattle holding. Each cattle owner must, by law, present his cattle for dipping. He has a card, showing his authorized holding and his actual holding, which is presented to the dip attendant. The attendant keeps a register of every owner showing the same details as the card. By this method a weekly check is kept on the number of cattle in the reserve and that they are being regularly dipped, the card being signed for each attendance at the dip. When calves are born, the attendant is notified and the new animal noted; a similar procedure is adopted when animals die or are slaughtered. A calf does not count as an animal until it is a year old, so that if farmer No. 5, William Yafele, had nine animals, and one of the animals calved, he has a year in which to slaughter one animal and so remain within the limit of his holding.

Whereas scientific breeding of animals is normal practice on European farms in Rhodesia, keeping one first-quality bull for the herd, this is obviously not possible under communal grazing. The method adopted for herd improvement is that at regular intervals the dip officer visits the tank on dipping day and castrates the inferior bulls, leaving one of the finer bulls to each village for breeding purposes.

Of the thirteen registered farmers in the kraal only six own ploughs and there are no scotch carts for conveying compost and manure to the lands. These are costly items of equipment, and the majority are therefore owned by men with employment outside the village. Those

without ploughs arrange to hire them from the more fortunate farmers and may have to hire, in addition, cattle, if they are not authorized cattle holders.

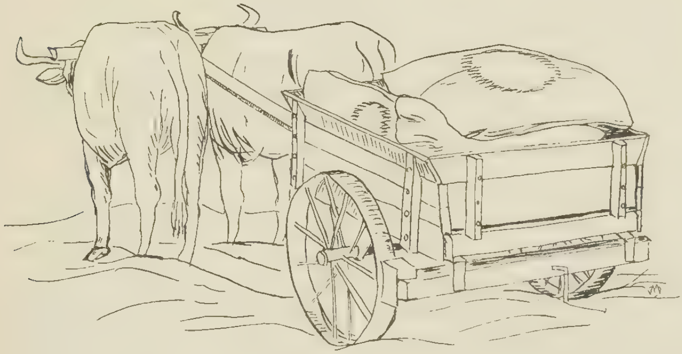


Fig. 4.—A scotch cart.

In conclusion, some of the problems arising in the agriculture of the village should be noted. The outstanding feature of Fig. 2 is the fragmentation of the crop divisions, seen very clearly in the case of 11. Mpewina, where, on five terraces, there are sixteen crop divisions. No adequate explanation for these divisions can be given. As they have been the custom, the practice still persists, making the task of supervising the agriculture and the enforcement of crop rotation very difficult. It is a regulation that the crops should follow the rotation: first year—maize plus manure; second year—maize; third year—legume; fourth year—rapoko; so that every other year the land is enriched by either manure or a leguminous crop. The enforcement of this regulation is virtually impossible as the demonstrator cannot remember the crop grown on every piece of land for 24 villages for every year. The failure to find a method of enforcing the rotation is the greatest hindrance to the improvement of yields. Many African farmers are still at the educational level where, if maize does well one year on a particular spot, they plant maize in the same ground the next year in the belief that a similar crop will result. It follows from the rotation that on any individual block of land, or for a village as a whole, the maize acreage should approximately equal the combined rapoko–legume acreage. The total figures for Yafele's kraal for 1954–55 (Table I) were maize, 42·2 acres and legume–rapoko, 12·1 acres, showing a far too heavy concentration on maize production.

Another problem is when farmers (e.g., 2, 3, 4, 6, 7) have no cattle to provide manure and cannot follow the rotation. Their poverty precludes their buying fertilizer and it is virtually impossible for them

to improve soil fertility and yields with only compost and leguminous crops. A European farmer with his knowledge of scientific farming would find it difficult enough to maintain his farming standards with no fertilizer or manure, but it is much more of a problem for an African with his limited educational standard and appreciation of modern farming practice. With regard to pastoral farming, there is a dire need for winter fodder for the cattle. The indigenous grass becomes very coarse and unpalatable during the dry season and the cattle generally lose weight. The veld grass makes good winter fodder providing it is cut in January at the height of the rains and stacked, but these practices and the development of improved pastures are still at the experimental stage.

The farming pattern of Yafele's kraal will by 1960 be general for all reserves in the country though differences of soil, slope and rainfall total will give rise to minor variations throughout the country. For example, in the centre of Southern Rhodesia around the towns of Hartley and Gatooma cotton becomes an important cash crop and farther south, in the vicinity of Bulawayo, where the annual rainfall drops to 20 inches, kaffir corn, a drought resistant millet, replaces maize and rapoko to some extent and cattle increase in importance, but the basic pattern of village line, contour ridge and fragmented terrace remains. Whether the standard of farming with its low yields, its small individual acreages and its lack of manure and fertilizer will ever establish a standard of living which will attract the settled farmer and arrest the drift of the males to the urban areas, only the developments over the next few years will show.

REFERENCE

[1] *What the Native Land Husbandry Act means to the rural African and to Southern Rhodesia*, Salisbury, Southern Rhodesia Government, 1955. Foreword.

# Population Mapping in Urban Areas

A. J. HUNT AND H. A. MOISLEY

THE IMPORTANCE OF PRACTICAL WORK, and of field work in particular, in the teaching of geography has long been generally recognized. Nevertheless teachers in urban areas may still find their efforts to arrange suitable field exercises hampered by lack of time or money for visits to open country and by the restricted nature of the urban environment itself. The possibilities of land-use mapping as one form of exercise to meet this difficulty have been reviewed in an earlier number of *Geography*.[1] In the present paper some methods and problems of urban population mapping will be considered from the teachers' point of view, though it is hoped that the discussion may also be of interest to others who are directly or indirectly concerned with the study of urban populations, and to town planners in particular. The paper draws upon the wholly independent experiences of the two authors in the conduct of experimental surveys; one in Sheffield in 1949, the other in Glasgow in 1955–8. Both of these surveys were carried out by university students under supervision, but in each case the work demanded no special training or experience and was well within the competence of advanced pupils in schools, or indeed of any person capable of observing and recording accurately on maps certain elementary facts about the use of buildings and their inhabitants.

The two surveys differed in purpose and scope but they yielded broadly similar results. Each of the population maps constructed contained much more detailed information about population distribution than those commonly found even in planning offices. The methods employed were complementary rather than alternative, yet either could be used or adapted for teaching purposes at an appropriate level. That used in Glasgow was the simpler, the quicker, and the one more likely to appeal to teachers with limited materials and opportunities for field work at their disposal. It will therefore be described first. The Sheffield survey was much more ambitious since it was undertaken partly as a research project and partly to furnish one of the surveys required in the preparation of the city development plan. An extended account of the survey will be found elsewhere so that attention will be confined to a brief outline of the method adopted, and to consideration of those

➤ Mr. Hunt, whose article on urban population maps is referred to on p. 89, is a lecturer in geography in the University of Sheffield. Mr. Moisley is a lecturer in geography in the University of Glasgow; he wishes to acknowledge the help given by the research staff of the Glasgow Corporation Planning Department and the patience of the students on whom the exercise was first tried.

points which shed further light on problems raised in connection with the Glasgow survey.[2]

*General considerations*

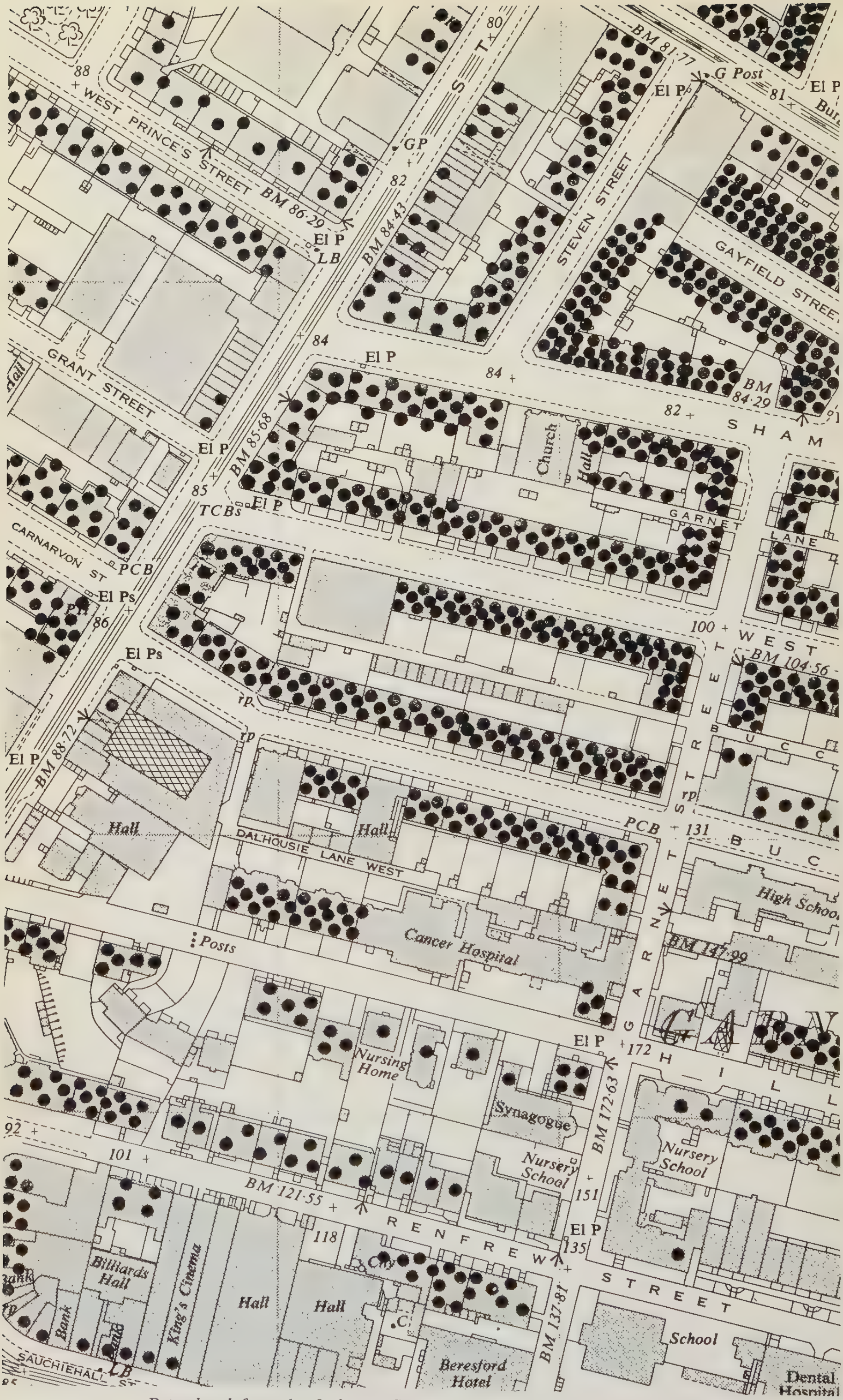
Decennial census reports are the primary sources of data for mapping distributions of population in Great Britain. In urban areas the smallest areal units for which figures are published are electoral wards. These are altogether unsatisfactory units in population mapping for several reasons. Firstly, they vary greatly in area and in population. In Glasgow, for example, the 37 wards range from a half to more than seven square miles in extent, and from 17,000 to 43,000 in population. Secondly, the population within any one ward is often very unevenly distributed; it is a well-known fact of urban geography that extremes of population density occur within very short distances. Thirdly, ward boundaries rarely bear any significant relation to spatial variations in the morphology or functional structure of an urban area. The census returns are limited in value by the ten-year interval between them. This means that maps based on the last census may be as much as ten years out of date, a period during which population transfers of considerable magnitude, both internal and external, may well have taken place. Brennan has estimated, for example, that the fourteen inner wards of Glasgow lost at least 70,000 out of a total population of 420,000 (16·6 per cent) between 1951 and 1958.[3] Movements of this order cannot adequately be analysed from maps based on decennial census data alone.

Electoral registers supply much of the information not obtainable from censuses and have the added advantage that they can be purchased separately for individual wards from the Local Registration Officer, usually the Town Clerk. The registers are revised annually and give the full address, street by street, of every person entitled to a parliamentary vote. With this information and large-scale base maps it is a simple matter to compile a precise distribution map of parliamentary electors. Indeed, if Ordnance Survey (post-Davidson Committee) 1 : 1250 plans showing house numbers or names are used, the plotting can virtually be completed without leaving the office or classroom. The only areas which need be visited are those where demolition, new building, or changes in residential use of buildings has taken place in the interval between revision of the plans and the enumeration of electors. If, on the other hand, less detail is required and it is desired to plot the total number of electors block by block instead of house by house, Ordnance Survey 1 : 2500 plans will be found quite large enough in scale for most built up areas, and a good deal more economical since one sheet covers the same area as four 1 : 1250 plans. From the teachers' point of view, the use of 1 : 1250 plans automatically eliminates one of the most instructive parts of a population mapping exercise, i.e. identification on the ground of the actual residential units to which the

Plate I.—Yafele's kraal: house types. In the foreground is a round kitchen house of brick; behind it a rectangular living hut and, in the distance, a raised food hut.

Plate II.—Yafele's kraal. Women stripping mealies outside a round kitchen hut, behind which can be seen a maize-drying cone.

Plate III.—Yafele's kraal. Individual farmers' cattle kraals.

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population figures refer. Base maps at 1 : 2500 or at 1 : 10560 may well be preferred for this reason alone.

Scale considerations aside, electoral registers have quite different limitations as source data from those of the census returns. In the first place, the registers include two classes of persons who should be excluded from all calculations: (a) those who will attain the age of 21 in the twelve months following the compilation of the registers (marked Y), and (b) those non-residents who are entitled to vote in local elections only (marked L). In the second place, if a map of the whole population and not just parliamentary electors is required, then it must be remembered that the registers also exclude all persons under 21 years of age, casual visitors (who are counted at their permanent place of residence regardless of their actual whereabouts at the time of enumeration), prisoners, the insane, and sundry others. Of these the under-21 group is by far the largest, and nearly always forms a substantial proportion of the population. The actual proportion varies markedly from district to district so that the ratio of electors to population varies likewise. In 1951 there were 1,089,767 inhabitants and 725,538 registered electors in Glasgow; the ratio of population to electors was, therefore, 1·502 to 1. In individual wards the ratios varied from 1·864 to 1 (Pollockshaws) to 1·246 to 1 (Camphill). In other words, figures obtained from electoral registers for these wards would have to be multiplied by factors of 1·864 and 1·246 respectively to give population figures. Such factors will, for convenience, be referred to as T/E (i.e. total population/electors) factors throughout this paper. The success with which electoral registers can be used in mapping population will be seen to depend mainly on the accuracy with which T/E factors can be calculated for any given area at a given time. Thus the relative value of the two methods of survey to be described depends very largely upon this one consideration.

*The rapid method*

In the Glasgow survey a map was constructed of the inner wards of the city, an area of some 10 square miles, to show the distribution of population in 1955 by the dot method. Each dot represented five persons, say roughly a single household, and the dots were located as nearly as possible in their exact positions. Part of the map was displayed at the British Association meeting in Glasgow in 1958. The survey was planned initially as a class exercise but was arranged in conjunction with the City Planning Department so that the data could

Plate 1.—A section of the final map, true to scale, 1:2500. It shows the wide range in densities of occupation within a small part of the city of Glasgow: in the northwest a residential area of moderate to low density, mainly former "west end" residences now used for business and professional purposes; eastwards high density tenements, approaching the industrial zone of the Firth and Clyde Canal (off the map to the northeast); and to the south the extreme north-western fringe of the central business district.

be used to form the basis for further enquiries, one of them into variations of population density in relation to residential land area and floor space, a matter of particular importance in areas like the older parts of Glasgow where multi-storeyed tenements are the dominant type of residence.

The method of construction was as follows:

(1) Electoral registers for 1955 were obtained for the appropriate wards. They were actually compiled on 10th October, 1954; therefore the map derived from them is a map of population distribution at that date. A T/E factor was calculated for each ward by dividing the total population of the ward by the number of electors in the ward, both figures being taken from the 1951 census tables.[4] It was in practice assumed that no significant change had taken place between 1951 and 1955 in the proportion of inhabitants to electors for any one ward taken as a whole. The validity of the assumption is examined below.

(2) The district to be mapped was divided into areas of manageable size for individual students. To minimize costs, each student prepared a tracing, from 1 : 2500 plans, of the streets and building blocks in his area. The tracings were then taken into the respective areas where the following information was recorded:

a. house numbers at the corner of every street block;
b. non-residential buildings (factories, commercial premises, etc.) with separate indication of buildings inhabited in upper floors or basements only;
c. the use of inhabited buildings (hotels, hospitals, etc.) to which the factor might not apply.

(3) On return to the classroom, each student entered on his tracing (the working sketch in Fig. 1) the number of electors counted in the electoral register for every street or street block in his area, excluding the shaded, non-residential portions. Figures for institutions and communal residences noted under 2 (c) were enclosed in boxes to ensure that the factor would not be applied to them. The procedure for determining the population of these institutions is discussed below.

(4) Each figure not so enclosed was then multiplied by the appropriate ward T/E factor and the corresponding calculated population was entered beside it in brackets. The calculations involved a good deal of simple arithmetic, an excellent opportunity to introduce pupils to the use of the slide rule.

(5) Finally, dots were placed on the 1 : 2500 plans in proportion to the calculated population block by block, one dot being equivalent to five persons, the minimum practicable value for one dot on this scale (Plate I). In other cases the optimum value would have to be determined in relation to the desired size of dot, the plotting scale, and the maximum density of population to be plotted in the whole area. For example, mapping on a 1 : 10,560 scale would be appropriate for many

purposes, in which case one dot could scarcely represent less than 25 persons in a densely occupied area.

The validity of the method depended fundamentally on the accuracy of the 1951 T/E factors and on their applicability to the 1954 electoral population. One difficulty arose because the factor was a generalization; it must be applied uniformly over the ward although, in fact, the actual ratio of population to electors varied from one block of buildings to the next. Preliminary experiments showed that the factors could

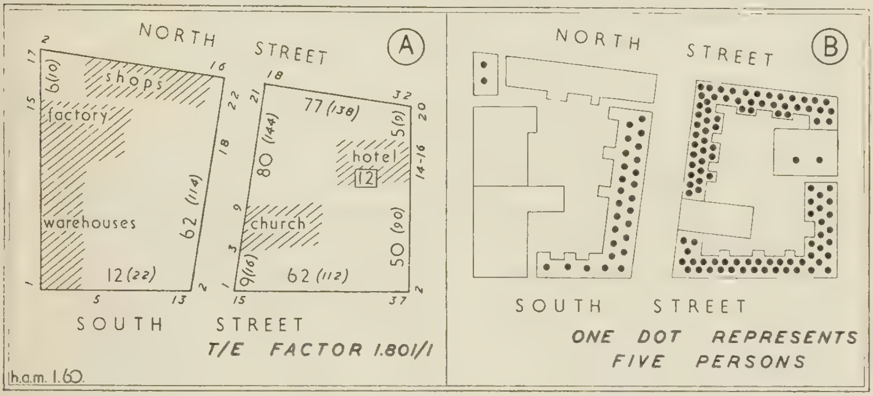


Fig. 1.—In A, the working sketch, the small numerals in the streets are house numbers, large numerals in the blocks are electors. Numerals in brackets are population estimates, obtained by multiplying electors by T/E factor. "Boxed" numerals are electors to whom T/E factor should not be applied, i.e. "institutional" population. B shows the finished map as drawn over an Ordnance Survey 1 : 2500 plan.

be significantly improved by calculating and applying them only to that portion of the population living in private houses, and by excluding what might be termed the institutional element of the population (i.e. those living in hospitals, hostels, lodging houses, etc.). The resident population of some such institutions is given separately in the Census (Table 27) but, in practice, a more complete list was obtained from the Medical Officer of Health. The population of such buildings can thus be recorded direct, without recourse to the electoral register. If this is done great care must be exercised to ensure that no person is counted twice (from the electoral register and again from the separate list), and for each ward, the institutional population must be deducted from both the total population and the electoral population figures given in the census before a T/E factor is calculated from them. This is necessary to ensure that allowance is made for the institutional element of the population both in calculating the T/E factor and in applying it to convert numbers of electors into calculated population figures.

A more serious difficulty is created by the assumption that, in any ward, the T/E factor will remain constant during any intercensal period. It might be thought that this could be avoided by using current estimates of population published for each ward by the local Medical

Officer of Health, instead of out-of-date census figures. That is not so, for the estimates are themselves based on the assumption of a constant ratio between electors and population since the last census, and further depend on the Registrar General's estimate of population for the whole city, also an approximation. Moreover, progressive outward movements of population such as those which have taken place in most large British towns during the last four decades continually alter the age structure of population in the areas affected. The population transferred from older, inner, residential areas to new housing estates near the municipal boundary is rarely, if ever, an average sample of the total population. Many of the new houses are allocated to young people with families; indeed in many cases the possession of a large family is a *sine qua non* for a high priority on the housing list. In the Govan ward of Glasgow in 1951 the average household contained 3·7 persons, but the average household re-housed between 1947 and 1955 contained 5·5 persons.[5] In consequence the T/E factor has tended to fall in the inner wards and to rise in the outer wards of cities. Clearly the use of T/E factors based on the preceding census may lead to quantitative inaccuracies as a result of changes both in the total populations of wards and in their age structure. The more remote the census the greater will be the inaccuracy. At the same time the assumed constancy of T/E factors cannot be avoided without a much more elaborate form of survey than that described above. These difficulties should not however be over-estimated. Just as the accuracy of a map diminishes as scale distortion in the projection framework increases away from the origin, so the accuracy of a distribution pattern diminishes as the areas to which the figures refer depart from their correct shape and size. This is precisely what happens when population data relating to specific residential areas are plotted on a map showing administrative divisions only: a distorted distribution pattern is obtained. Conversely, the value of population maps of the type under consideration depends upon the elimination of this kind of distortion by plotting the population data in their appropriate residential areas quite independently of administrative boundaries. The details of the resulting pattern are derived solely from the electoral registers, the most accurate source obtainable. They are comparatively little affected by overall quantitative errors, even considerable ones, which may occur from ward to ward. On these grounds it is reasonable to conclude that the construction of urban population maps by the rapid method used in Glasgow is well worth while both as a class exercise and for the intrinsic value of the maps produced. The possibility of improving on the method by the direct determination of T/E factors will now be considered.

### *A more refined method*

The method of survey used in Sheffield differed from the preceding in one important respect. The work was carried out for and with the full

co-operation of the City Planning Department, so that all necessary materials and labour were ready to hand. Students who recorded most of the field data did so as temporary employees of the Planning Department during their long vacation. An exceptionally detailed and accurate survey of the use of land and buildings in the city was already nearing completion. This eliminated the need for the mapping of residential areas so that all the time and energy of the field party could be devoted to the recording of population data *per se*.

Although the last census had been taken eighteen years previously, in 1931, the next was due in 1951 and a full private census would so far have exceeded the requirements of the 1947 Town and Country Planning Act that it would have been an unjustifiable expenditure of time and money. It was accordingly decided to attempt a sample census with the sole object of obtaining separate T/E factors for polling-districts, the smallest electoral divisions, by actual counts of population in the samples. By this means it was hoped to avoid the difficulties, noted above, arising from the use of out-of-date census figures, and also to reveal internal variations of population density within wards more accurately than could be expected by the use of only one factor per ward.

The procedure adopted was as follows:

(1) A table of numbers of electors, street by street, was prepared from the electoral registers.

(2) Photographic enlargements at 1 : 1250 of Ordnance Survey 1 : 2500 plans (prepared under licence from the Ordnance Survey) were chosen as field sheets because they were already available in the City Planning Department. New style 1 : 1250 plans were not then published. In practice 1 : 2500 plans would have been less cumbersome and quite adequate for the purpose. On the field sheets were marked (a) the boundaries of wards and polling districts, and (b) sample units or blocks of ten consecutive dwellings each. The number of samples per polling district was determined by an arbitrary ratio of one sample per 300 inhabitants. Since an average sample of ten dwellings contained more than thirty people, at least one tenth of the whole population was thus to be counted. This was estimated to be the minimum proportion to yield reasonably satisfactory results. Within each polling district sample units were selected and plotted on the maps as evenly as the irregular distribution of houses permitted. Departures from an even distribution of samples were however made deliberately wherever necessary to ensure that, in each polling district, the number of samples of each distinctive house type (detached, semi-detached, terraced, flatted, back-to-back, etc.) was roughly proportional to the number of houses of that type in the district. This precaution was considered desirable to allow for the fact that population densities in towns vary with types of property as well as with their geographical location.

(3) Field recorders then visited each sample unit in turn, counted the number of inhabitants and adults in the sample, and recorded each

pair of figures on the map as a ratio, e.g. 36/24. Whenever householders were absent or unco-operative, the nearest complete sample of ten consecutive dwellings was counted instead of that originally specified.

(4) In the drawing office, all the sample ratios for each polling district were totalled, meaned and converted to an average T/E factor for the district. In one polling district, for example, there were 128 persons and 99 adults in 5 samples, averaging 25·6/19·8 per sample and giving a T/E factor of 1·295. The validity of these factors was then tested by listing all the polling districts, and beside each the number of electors, the calculated T/E factor, and their product—the calculated population. The calculated total for the City was 531,404 compared with the Registrar General's current estimate of 514,400, a difference of 3·3 per cent. It will be noticed that for this purpose numbers of adults were assumed to be equivalent to numbers of electors. In this respect the method could have been improved by making allowance for the institutional element of the population as was done in the Glasgow survey. Nevertheless the 3·3 per cent difference was regarded as small enough to justify completion of the mapping from electoral registers and calculated T/E factors. It was assumed, and rightly so as the 1951 census showed, that the Registrar General's estimate was likely to be more accurate as an overall figure than the calculated total, and that the 3·3 per cent difference in the two figures was the accumulated error, or algebraic sum, of the errors in the calculated polling district totals resulting from the sampling procedure. The initial factors were accordingly scaled down to make the gross total agree with the Registrar General's estimate. The amount of correction applied to each factor was weighted in proportion to the number of samples from which it had been derived, and further weighted to make the calculated totals for each ward agree with the best available estimate, namely that published by the Medical Officer of Health, for the city. The purpose of the correction was to prevent overall quantitative differences between wards from being distorted by progressive accumulation of sampling errors. Interested readers will find a full description of the method of adjustment and some discussion of its implications in the account of the survey cited above.[6] The important point is that sampling errors were confined to the wards in which they occurred. Differences between polling district factors within each ward were slightly reduced in the process of adjustment, but not enough to make significant alterations in the pattern of density variations revealed by them.

(5) Adjusted T/E factors were next applied to the table of electoral population by streets and the final calculated population of each was obtained. These figures were then plotted on the field sheets which thus became the record maps for the survey.

(6) Lastly, all residential areas in the city were outlined and shaded on a set of six-inch maps by reference to the land-use survey maps.

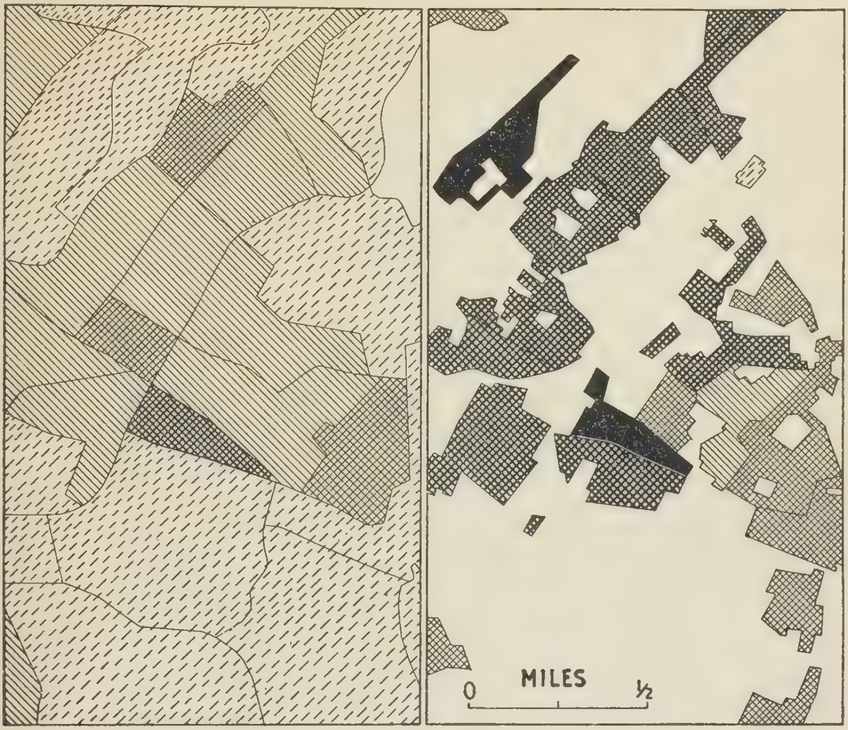


Fig. 2.—The contrast of mapping effect when density of population is shown by (a) polling districts and (b) residential areas. Both maps depict the same part of Sheffield. The same range of shading tones (from under 30 persons per acre to over 120 persons per acre) is used in both maps. This figure was first published in the *Town Planning Review*, vol. xxiii, 1952, p. 239, and is reproduced by kind permission of the Editor of the *Review*.

On each residential block was recorded the area (measured by planimeter), the population (counted from the field sheets), and the calculated density. Areas were then shaded appropriately to show density of population. A dot map was compiled from the same data by a method similar to that used in Glasgow. Both maps have since been extensively used for planning purposes, for teaching and for research.

The use of a sampling technique for collecting population data in this way raises a question to which there is no really satisfactory answer: does a population distribution obtained partly by sampling reflect the real distribution more, or less, accurately than one prepared by a speedier method, even perhaps by direct plotting from the electoral registers? It is possible, for example, that the errors in total population calculated for individual polling districts were much greater, plus or minus, than the accumulated error (3·3 per cent) of the whole survey suggested. Only a full census near the time of the survey could have settled this point. Examination of the finished maps in the light of independent evidence suggests that large errors were confined to a

few districts and that the sampling procedure did, on the whole, produce useful results.

It would however be a mistake to infer from the relative success achieved by sampling in the Sheffield survey that sampling techniques are generally applicable to the analysis of population distributions. In that instance the detailed distribution pattern was firmly tied to two reliable sources—the electoral registers and the nearly contemporaneous land-use survey. Information obtained by sampling influenced the pattern to a limited degree and in one way only, i.e. in the relative differences in density and in total population between each polling district as a whole and the others. The use of sampling was considered valid only within these well-defined limits. As a general principle, it is probably best to regard sampling as a technique to be used only as a last resource and then only under strict control.[7] The Sheffield survey embraced half a million people and some 15,000 houses. About ten thousand houses were actually visited by field-workers in a total of thirty man-weeks, each worker visiting 300 to 400 houses per week. The total time taken was estimated to be less than a tenth of that required for a full census. Herein lay the main justification for the method adopted. Exceptional circumstances prevailed at the time owing to the absence of a census in 1941.[8] Sampling was the only practicable method of obtaining the required information.

### *Conclusions*

The general justification for developing methods of population mapping such as those discussed is that published urban population data are either incomplete or refer to rather large administrative areas, whereas geographers, planners and sociologists require data relating to small areas defined in terms of their specific use rather than by administrative boundaries. The importance of this point will be evident from Fig. 2. The methods outlined are two means of achieving greater accuracy than is possible by direct plotting from electoral registers on one hand, and a very big saving of time and labour compared with a complete census on the other. A simple method is probably adequate for most purposes. More refined methods are justifiable only if they produce appreciably more accurate results. Their use is a matter of choice and in any particular case the final selection will depend on the purpose of the survey and the time and money available. Substantial refinements involve sampling, i.e. the taking of a complete census of selected areas, and for this field work is essential.[9]

The immediate aim of all such surveys is to acquire population figures for the smallest convenient areas. In the Glasgow and Sheffield experimental surveys figures for street blocks or residential parts of them were distinguished. Data so obtained can be used as basic material for the construction of maps to show the actual distribution of population (i.e. dot maps) of the relative distribution in terms of density per

unit of total area, residential area or floor area and so forth. The value of the data to planners has been proved beyond question both in the preparation of development plans and in the day to day work of planning, which frequently calls for rapid estimates of populations of small areas. Its value to geographers as research material needs no demonstration. It is also hoped that the methods described in this paper may prove of value to teachers as the basis for practical exercises which focus the attention of pupils on one of the fundamental aspects of urban geography.

REFERENCES

[1] A. J. Hunt, "Land-use survey as a training project", *Geography*, vol. xxxviii, 1953, pp. 277–86.

[2] A. J. Hunt, "Urban population maps", *Town Planning Review*, vol. xxiii, 1952, pp. 238–48.

[3] T. Brennan, *Re-shaping a City*, Glasgow, 1954, p. 154. His figure is based on the Medical Officer of Health's estimates and is probably an under-estimate.

[4] *Census of Scotland*, 1951, vol. I, pt. 2, table 7.

[5] T. Brennan, *op. cit.*, p. 164.

[6] A. J. Hunt, *op. cit.* (1952), pp. 243–5.

[7] For a general discussion of sampling methods see F. Yates, *Sampling Methods for Censuses and Surveys*, London, 1953.

[8] National Registration and Food Office Records which might have helped to fill the gap did not cover the whole population nor were they available for this kind of work, even in planning offices.

[9] At the time of writing the Geography Department of the University of Glasgow, with the co-operation of Glasgow Corporation Planning Department and of senior school pupils, are attempting a map of the whole city. The intention is to apply factors obtained by sampling to residential areas defined with the aid of a preliminary map constructed by the rapid method.

# Film Use in the Lesson: An Analysis

J. W. N. HILL

THESE NOTES describe the actual use made of a film in a series of geography lessons at a secondary modern school. Some attempt is made to draw conclusions from the results of these lessons with special regard to the value of the film in the learning process. There can, of course, be no single, exclusively correct, procedure for using a film in a lesson. So many variables have to be considered that different methods of presentation have to be employed not only with each class or age group but also with each film. The aim of this article is, therefore, merely to make some suggestions and to give the basis for further experimentation by describing in some detail the use of a particular film and by analysing the results obtained from it.

The film *Golden Fleece** formed the basis of lessons given to seven separate forms; one each with all six streams of the first year (A1 to A6) and the seventh to a second year form (B1). It was introduced into the week's work not as a special treat, but as a natural and correlated part of the school geography syllabus which covers Australia in the first year. What is more important is that it was accepted as such by the pupils. Too often in school the film, as a teaching medium, is introduced so rarely that the pupils are excited at the prospect of a "film show", an attitude which blunts the child's desire to learn by the novelty of the medium. From the teacher's viewpoint also it is essential that the film should fit neatly into his course of work, and thus supplement rather than interrupt it.

Filmed in black and white, *Golden Fleece* runs for fourteen minutes. It is, therefore, admirably suited to classroom use where films need to be shown at least twice. It is twenty-four years old and although the photographic quality is not up to contemporary standards the photography is straightforward and the message each shot gives is clear and unambiguous. It is a sound film, but the writer preferred to screen it silent and give his own commentary which enabled him to stress the points most suited to his scheme of work and to adopt it to the needs of the pupils of this school. This attitude accords well with the findings of an investigation into the relative effectiveness of sound and silent films, made by G. Q. Craig.[1]

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* *Golden Fleece* is distributed by the Film Library, Australia House. It is readily obtainable and the cost is 2s. 6d. for the first day of showing and 1s. for subsequent days. Although made in 1936 (no new edition has been issued), none of the essentials of the film is dated.

*Golden Fleece* traces in a clear and simple manner the story of wool from the sheep's back to the auction room at the Wool Exchange. The opening shots are of the sheep being mustered on a station, possibly in the Darling Basin, in which the large flocks and the characteristics of the Merino in close-ups are admirably shown. The rather dry sheep country and the appearance of the sheep-men are also well featured in the film. Considerable attention is given at this stage to dipping and the disinfecting of fleeces and mouths; the grimaces of the sheep at such treatment caused amusement amongst the children.

Exceptionally good shots illustrate the skilled workmanship of the shearer, which forms the next stage of the film. The practised method of holding and controlling the animal and the direction of shear cuts to preserve the entirety of the fleece are, in the opinion of the writer, outstanding features of the film.

Leaving the sheep, fleeced and considerably thinner, the camera passes on to the skirting and classification of fleeces. The experienced hand and eye of the sorter are shown and the film proceeds to the next stage of marking the bales for transport. The bales are taken by truck and rail to the warehouse where they are shown being weighed and recorded. The penultimate scenes are of prospective buyers inspecting the fleeces from the opened bales in preparation for auction and the film closes with a number of shots of the auction itself, where some animated bidding, exaggerated by the rather artificial speed of the film, takes place.

From this brief synopsis of the film it will be clearly seen that it divides itself into well-defined sections which make for ease of use in the lessons. These sections and the use made of them are dealt with at a later stage.

*Pupil use of the film*

It is a truism that hardly needs re-stating that the basis of all good teaching is the pre-lesson preparation of the material. The film lesson is no exception to this rule. The writer made a personal preview of the film, seeing it through four times, thus ensuring that he became fully aware of its contents and able to guide the children in their use of it, for the film should be used by the class for learning and not by the teacher for teaching. During this preview (at which older pupils might well be present) questions that needed answers were discovered and other visual material was later chosen for introduction at various strategic points in the lesson.

Two devices were used to ensure proper use of the film by the pupils. The first was the provision of background material. In previous lessons they had been given notes on the rainfall regimes of Australia, and the Darling Basin had been named as the chief sheep region; the problem of drought and the methods by which stock are watered had been explained. But the second was the more important method—the use

of the duplicated questionnaire, issued and answered after the final screening of the film. This form of questioning was preferred to the oral method for various reasons: the questions posed were such as to make the pupils analyse their impressions of the film and the great deal of information it conveyed, and to assimilate its total message. The questions themselves were simple and unambiguous and for the most part needed only the insertion of a single word to complete the answer. They were split into two sections: one requiring the recollection of facts from the film and the other needing some assessment of the qualities of the film itself.

Fifteen minutes at the end of the lesson were allocated for the completion of the questionnaire and a further five minutes for marking, done by the pupils themselves. After the results were checked the sheets were returned to them as a form of revision notes.

The children themselves received the duplicated questionnaire method with some enthusiasm and this itself is an indication of its great value. It not only gives the pupil practice in precise answering, but also, of far more importance, gives each pupil the responsibility for his or her own sheet. The results were more than encouraging, for, although the answers were to be found in the film itself, they compared favourably with the results from oral questioning made on similar occasions. Moreover, oral questioning limits the number of pupils who may answer whilst answering is passed on as a duty to all pupils on the questionnaire page.

### *Mechanics of the lesson*

To provide a more equitable basis for a comparison of the results obtained by the individual forms no great changes were made in the techniques used in each of the seven lessons. The topic was treated in less detail with the lower graded forms (i.e. A6, A5 and A4) and minor changes of order were made; but if the statistics were to be of any value at all they would have to be based upon lessons using similar methods.

The format of the lessons was organized as below:

(1) Introduction (5 minutes).

No attempt was made to "steal the guns" of the film at this stage, but the mere indication of subject was considered to be insufficient. The children were given an outline of the film's story and, of greater importance, they were made aware of the main points for which to look. In this way they were helped in their analysis and urged to be selective, thus avoiding wastage of attention which might otherwise have been directed along unprofitable or irrelevant paths.

(2) First screening (15 minutes).

It is generally agreed amongst geography teachers that one screening is insufficient for a film when it forms the basis of a lesson. In six of the seven lessons the first screening was made continuous. In the seventh case, where the first screening was broken, it was evident that there

was some considerable impatience on the part of the children to "get on with it". This, it is thought, stemmed from their innate curiosity and was something to be preserved. It was felt, therefore, that to contain this enthusiasm and to foster unbroken concentration from the start of the lesson the first showing should be made complete and unbroken.

Also noticeable was the fact that children were tempted to raise their hands for questions, but the teacher's commentary could not have been interrupted as the film would have "run away from him".

(3) Interval (10 minutes).

During this period the film was rewound, but the time was put to good use. By consulting a rainfall map of Australia the class decided that the station in the film was most likely situated somewhere near the 20-inch isohyet. Comparison with a stock distribution map confirmed their decision. They were told about foot-rot and were urged to notice especially in the second screening the shots of the sheeps' feet where the cloven hooves were well illustrated. From this information they deduced the logic of the comparative sheep scarcity on the Eastern Rain Coast.

The story of the wool was then followed briefly from where the film left off. Pupils traced in their atlases the journey of a cargo boat from Sydney to England and a train's route to the West Riding. Then followed a brief description, with the aid of wall charts, of the processing of wool from washing, through carding and combing, etc. to the finished knitting wool. To help them in their understanding of what actually happens to the wool at each stage in the process a card of specimens produced by a commercial firm was passed around the form for each pupil to see and feel the changing texture of the raw material.

Whilst the film was being re-laced, the various sub-divisions into which it would be broken in the second showing were explained to the pupils.

All the subjects mentioned above were, of necessity, not discussed in detail as the amount of time available was limited. Indeed, the time factor had to be watched very closely at all stages and any discussion that promised to prolong itself had, unfortunately, to be terminated.

(4) Second screening; Broken into sections (25 minutes).

As pointed out above, the *Golden Fleece* was divisible into a number of clear-cut sections: (*a*) Mustering; (*b*) Dipping; (*c*) Shearing; (*d*) Skirting and classifying; (*e*) Transportation; (*f*) Inspection by buyers; (*g*) The auction.

As each of these sections ended the film was stopped. It was at this stage that the various points of information regarding the section were recapitulated and further developed to assist the pupil in his assimilation. Questions were answered and misunderstandings and confusions were untangled. Further use was made of other visual aids and charts.

It was found that the film gave rise to more questions than was normally to be expected in the case of all forms except B1 (second year) and A1 and A2 (top streams of the first year). One concludes from this fact that, other things being equal, the medium stimulates thought more than others used with lower-graded forms.

The other types of visual aids used during the lesson may be regarded as competing with the film for time, but they are, in essence, complementary to it and explain in static terms what the film covers in the dynamic medium. They should, however, be chosen with great care and the timing of their introduction carefully planned. Often, if these considerations are not given their due, additional aids can confuse and do more harm than good.

(5) Questionnaire and marking (20 minutes).

Fifteen minutes were allowed for answering the question sheets: five minutes were allowed for marking after the pupils had exchanged sheets. On studying the papers it was found that roughly 95 per cent of the pupils had completed all questions in Section 1.

(6) Follow-up to the lesson.

In this particular case the follow-up was confined to one homework period in which the children drew a map showing the distribution of sheep in Australia, the rivers Murray and Darling and four main ports. With more mature pupils another type of homework might have been a written summary; alternatively, some special aspect of the film, a town or tool or the animal itself, might have been the subject for further research beyond the compass of the film.

### *Conclusions*

The first result derived from the showing of *Golden Fleece* was that by the medium of the film greater enthusiasm for the topic was created than even the best teacher could attain by his verbal description alone. In essence the oral lesson is a poor substitute for actually seeing the subject or visiting the places in real life. The film, though still a substitute, is a better one than words alone as it does transport, to a greater degree, the imagination of the pupil from the classroom to the sheep station. This is, of course, no newly discovered fact, but these lessons did give practical demonstration of it.

### *Results from the statistics (see Appendix I)*

No claim is made to prove conclusively any theories by this analysis. It will suffice merely to support and illustrate some trends discernible by the teacher from his impression of the pupils' reactions to the lesson. From the statistics the following points may be made.

(1) There is no clear-cut correlation between the answers and the I.Q. grading of the six first-year forms. It is significant that a boy in A6, the lowest-graded first-year form, should get 100 per cent whilst the

average mark of A1, the highest-graded first-year form, should be 72 per cent.

(2) The lowest mark obtained from seven different graded forms taking exactly the same paper is 25 per cent. It is felt that this is significant for if this could be taken as the floor level mark for all lesson tests the teacher would be greatly pleased. It seems, therefore, that the use of the film medium may raise the potential bottom mark.

(3) Three factors prove to be of further significance:

*a.* Only 19 per cent separates the highest and lowest average marks of the first-year forms.

*b.* 10 per cent is the maximum difference between the highest first-year marks.

*c.* 15 per cent is the maximum difference between the lowest first-year marks.

It seems, therefore, that the film reduces to a universally understood level of communication the information to be transferred. The statistics tend to suggest that the lowest-graded forms do not lack the native intelligence attributed to the higher forms. Their difficulty is to be found in their lack of skill in verbal and written communication. The difference in their level of attainment is to some large extent eliminated by using the film as the medium, although, as Craig proved in his investigation, the commentary of sound films often confuse backward children.[2]

(4) Thus, following on from the last statement, the film proves to be of greater marginal value with the lower-graded forms than with higher-graded forms.

(5) The difference in the ability of the forms is made adequately clear by the answers given to Section II (questions 21–24). These questions were posed for two reasons: first, as part of a process to develop a critical sense and secondly, to give the writer some idea of what the children thought of *Golden Fleece* as a film. A contrast in critical facility between forms A1, B1, etc. and forms A4, A5 and A6 is evident from the results, shown in Appendix II, of the numbers of suggestions made. This difference is perhaps due to the restricted mental horizon of the lower-graded pupils stemming from lower reading ability, and therefore less wide and advanced scholarship. Some of the answers to question 24 are interesting:

"I would show how it goes through carding and comes out knitting wool."

"I think I would show how it is transported to another country."

"A close-up of the sheep and the material in the bales."

"I would show maps of where the main sheep places are."

"More about the sheep itself."

It must be immediately allowed that many readers will find themselves in disagreement with some of the statements made in the

last section. This is inevitable as they are generalizations based upon a restricted survey. Nevertheless, the showing of *Golden Fleece* demonstrates that the film can play a great part in the teaching of geography. The technique employed in this case is only one method of using a film in teaching. There are, of course, other ways and these notes are intended only as suggestions. Only by individual experience can the teacher devise his own technique.

REFERENCES

[1] G. Q. Craig, "A comparison between sound and silent films in teaching," *British Journal of Educational Psychology*, vol. xxvi, 1956, pp. 202–6.
[2] *Op. cit.*, p. 206.

## Appendix I

STATISTICAL ANALYSIS OF RESULTS FROM QUESTIONNAIRE

| Forms | B1 | A1 | A2 | A3 | A4 | A5 | A6 |
|---|---|---|---|---|---|---|---|
| Number in form | 31 | 34 | 32 | 34 | 32 | 33 | 27 |
| Average form mark % | 81·5 | 72 | 72 | 75 | 62·5 | 56 | 65 |
| Highest mark % | 100 | 95 | 100 | 95 | 90 | 90 | 100 |
| Lowest mark % | 60 | 35 | 40 | 40 | 35 | 25 | 25 |
| Answers to Q. 21 | | | | | | | |
| Yes | 28 | 34 | 32 | 33 | 31 | 33 | 27 |
| No | 3 | 0 | 0 | 1 | 1 | 0 | 0 |
| Answers to Q. 22 | | | | | | | |
| Yes | 23 | 30 | 31 | 33 | 30 | 28 | 23 |
| No | 8 | 4 | 1 | 1 | 2 | 5 | 4 |
| Answers to Q. 23 | | | | | | | |
| Yes | 26 | 33 | 30 | 23 | 31 | 33 | 25 |
| No | 5 | 1 | 2 | 11 | 1 | 0 | 2 |
| Answers to Q. 24 | | | | | | | |
| Cases of suggestions made | 18 | 14 | 14 | 20 | 9 | 11 | 4 |
| No suggestions made | 13 | 20 | 18 | 14 | 23 | 22 | 23 |

## Appendix II

PUPIL QUESTIONNAIRE FOR FILM "GOLDEN FLEECE"
(15 *minutes allowed for completion*)

*Section I*

Q. 1. The first part of the film shows sheep being gathered in for shearing. What is this process called?

Q. 2. What type of sheep is shown?

Plate I.—The Neuwied Basin: the wooded ash cone of Kunkskopf, broken on one side by a quarry. In the foreground an "unenclosed" landscape of arable lands, still showing strips (maize on one strip in foreground). Photograph by T. H. Elkins.

Plate II.—The Neuwied Basin: a shallow working in the Bims. The white bands in the face are Bims; the dark bands are dust. The dust took longer to settle than the Bims and the layering is proof of the periodic nature of the explosions during which the maars were formed. Photograph by T. H. Elkins.

Plate I.—Kariba gorge, looking downstream from the dam, and illustrating the dissected and inaccessible nature of the terrain in which the Kariba project has been completed. Photograph by Central Press Photos Ltd.

Plate II.—Kariba gorge, looking upstream from the dam over the partially filled lake. Photograph by kind permission of the Federal Power Board, Salisbury.

Q. 3. In one scene a windmill is shown. What is it used for?
Q. 4. What is the Australian name for field?
Q. 5. Why is it necessary to "dip" sheep?
Q. 6. What type of shears are used by the shearers?
Q. 7. How long does it take a shearer to fleece a sheep?
Q. 8. What holds the fleece in one piece?
Q. 9. Are Australian flocks larger or smaller than British flocks?
Q. 10. Why are horses used by Australian sheepmen and not English shepherds?
Q. 11. How is wool sorted?
Q. 12. What things are looked for in classifying fleeces?
Q. 13. The fleeces are spread on a table, sorted, and soiled or coarse parts of the edges are torn off. What is this process called?
Q. 14. The fleeces are packed into bales for transportation. (1) Of what material are the bales made; (2) approximately how much does each bale weigh?
Q. 15. Where do you suggest the train is bound for?
Q. 16. What sort of people are inspecting the opened bales in the warehouses?
Q. 17. Mention two qualities of good wool.
Q. 18. How is wool sold?
Q. 19. Name the two major wool-producing states of Australia.
Q. 20. What is the name of the special building in which wool is sold?

*Section II*

Q. 21. Does this film give a good impression of the story of wool? Yes/No.
Q. 22. Would it have been better in colour? Yes/No.
Q. 23. Do you consider the photography was generally good? Yes/No.
Q. 24. Is there any improvement that you would make to the film?

# This Changing World

## THE KARIBA PROJECT

Towards the end of 1958 man achieved one of his greatest triumphs over the forces of nature when, by the completion of the wall of the Kariba dam he tamed the mighty Zambesi. Several aspects of this project—topographic, sociological, economic and political—are of interest to geographers. The waters now rising slowly behind the dam will form the largest artificial lake in the world, with consequent local effects on climate, vegetation and animal life. During the project a primitive, riverine people, former inhabitants of this part of the Zambesi valley, have been resettled in new environments. The economic consequences of the scheme have yet to be developed, but they can already be considered in anticipation, and they in turn will reflect the political bonds which the building of this dam has created for the Federation of Rhodesia and Nyasaland.

*The physical setting*

One of the greatest difficulties encountered in the building of the dam was the inaccessibility of the Kariba gorge, a fact which is directly related to the structure and geomorphology of the Zambesi basin. On its 1700-mile course to the Indian Ocean the Zambesi in its upper and middle portions flows through two belts of country which are distinct geomorphologically. In the west the upper Zambesi crosses the featureless Kalahari Sandveld in a generally wide, shallow valley which ends abruptly in the Victoria Falls where the river crosses on to the basalts at the top of the Karoo system. Below the Falls the river is confined in the deep, narrow Batoka gorge. East of this lies the middle, Gwembe section—a broad down-faulted trough zone linked structurally with the rift valley system of East Africa—in which the Kariba gorge is situated 300 miles downstream from Victoria Falls. Here the Karoo rocks have been let down and preserved between the great plateaux to north and south, composed of Archaean basement rocks, mostly granites and gneisses. The plateaux terminate in steep escarpments, some 2000 feet from foot to crest, which tower over the Zambesi trough. Complex faulting gives rise to a multiplicity of features on the escarpments which formerly rendered the river valley and Kariba gorge remote and inaccessible. (See Plates I and II facing p. 97.)

The history of the Zambesi's course dates from the rifting of mid-Cretaceous times. Following the trough faulting in the Gwembe valley and headward erosion from the east coast, the drainage, originally west flowing towards the Kalahari, was diverted towards the Indian Ocean. Active downcutting has stripped the younger rocks and the Zambesi is superimposed on the older rocks below, a process which continues upstream to-day at the Victoria Falls. In the Gwembe section itself, the post-Karoo rocks have been practically removed, the stripping of the Karoo rocks is going on, and, in the Kariba gorge, the resistant gneisses of the Archaean basement are exposed, creating a gorge within the down-faulted trough.

The enclosed nature of the Gwembe valley, at an average altitude between 1200 and 1700 feet, and of the Kariba gorge in particular, is responsible for the hot stifling conditions that have prevailed there. The rainfall probably averages about 30 inches annually, concentrated in the period November to February, with the rest of the year virtually rainless. Records from the Kanchindu mission (1550 ft. a.s.l.) show a mean maximum temperature of 91°F. and a mean minimum of 65°F. The hot conditions within the valley are unrelieved by the cool winter nights of the plateau or by winds, and are, according to the season, oppressively humid or excessively dry. Soils and vegetation reflect these conditions. Almost pure mopani woodland (*Colosphospermum mopane*), associated with black alkaline

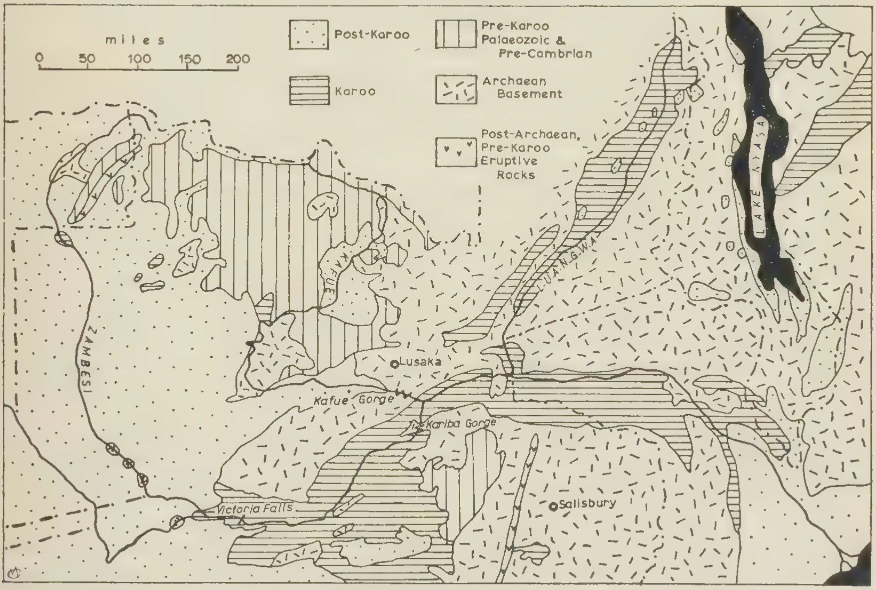


Fig. 1.—Geology of the Zambesi basin.

clays, covers most of the valley but here and there, usually on sandy soils (possibly relics of the former Kalahari sand cover) there are patches of Londe thicket composed largely of *Commiphora* and *Combretum* species, with an occasional mukwa tree (*Pterocarpus angolensis*). Giant baobabs (*Adansonia digitata*) are scattered through both types of vegetation. In places the thicket is very dense, thorny and difficult to penetrate but its soils are the most easily cultivated. Giant bulldozers and heavy tackle have been used to clear both types of vegetation for new settlement and for fishing grounds on the new lake bottom.

*The dam and installations*

Before work could be started, because the Zambesi is an International River, agreements had to be made with the Portuguese, South African and British governments in order to safeguard interests in Angola, Mozambique, the Union of South Africa and Bechuanaland. An adequate supply of

water was assured to Mozambique during the construction period by a specified minimum flow from the gorge. An anticipatory guarantee of sufficient water to supply the power houses while the lake is filling has been agreed by the Portuguese, by limiting the quantity of water abstracted from the Zambesi for irrigation in Angola as far ahead as 1975, by which time Mozambique will be benefiting from the regulated flow of the river below the dam. The Union of South Africa and Bechuanaland Protectorate are also riparian to the Zambesi, but at present their interests in the river are limited.

Preparatory work on the site of the dam was started in mid-1955, responsibility for the project being taken over in 1956 by the Federal Power Board set up by the government of the Central African Federation. The site selected is 2½ miles downstream from the entrance to the Kariba gorge and the initial tasks were the provision of access roads from north and south, African and European townships on the heights to the south, railheads at Kafue in Northern Rhodesia and Lion's Den (northwest of Salisbury) in Southern Rhodesia, an airfield, and road and footbridges over the Zambesi itself. On a river whose flow varied from 16,000 cusecs in the dry season to about 200,000 cusecs in the rainy season, constructional work had to be accommodated to very variable conditions, and involved the building of coffer dams first on the northern side, then on the southern, and of a diversion channel (tunnel). Underground power stations have been excavated in both northern and southern walls of the gorge, and the first turbines were installed in 1958, in which year the erection of power lines to Salisbury and Bulawayo was started. By October 1959 the power lines to Kitwe and the Copperbelt were completed. It is an outstanding achievement that, in the face of extremely difficult working conditions in an area previously devoid of communications and in the heart of Africa, with the vagaries of a river régime including a disastrous flood in 1958, the Kariba hydro-electric supply is to be opened in June 1960, exporting first of all to the Copperbelt.

The dam wall, rising 420 feet above the foundations, will eventually raise the dry weather river level by about 340 feet (some 1550 ft. above sea level) and will create a lake extending upstream in a south-westerly direction for 175 miles, as far as the lower end of the Batoka gorge. The lake will have a total surface area of over 2000 square miles and will store about 130 million acre feet, four times the capacity of Hoover Dam, hitherto the world's largest man-made lake. (By the end of 1959 the volume had reached 26–million acre feet.)

The installation of generating sets at Kariba will be in stages year by year with output geared to meet the most urgent demands and at the same time to work in with existing thermal electricity production. When eventually completed, with at least 12 turbo-generators installed, Kariba will be the largest power project in Africa, with a capacity of 1200 megawatts. Although actual energy output can as yet only be estimated (depending on the average head available at the turbines and the average firm flow of the river), an output of 8180 million KWh is calculated. With high and continuous demand, in terms of annual energy output and because of its high load factor, Kariba will probably be the largest hydro-electric station in the world.

*Economic importance of the project*

The Federal decision to build Kariba dam and power station was prompted by the urgent and increasing post-war demands for power in the Northern Rhodesian Copperbelt and the growing mining, industrial and farming areas extending along the watershed from Salisbury to Bulawayo in Southern Rhodesia.

Copper production in Northern Rhodesia, 175,000 tons in 1945, rose, with fluctuations, to over 416,000 tons in 1957, an output nearly 10 times greater in value than the 1945 figure, because of the greatly increased price of the mineral. In 1958 world over-production resulted in a 10 per cent cut in production, but the market has now recovered and the Copperbelt is producing to full capacity. With a stable price of £250 per ton and production of around 400,000 tons per year, this region's output, in value estimated at £100 million, would represent 95 per cent of the national income of Northern Rhodesia and nearly 25 per cent of that of the whole Federation. The assurance of adequate power supplies to the Copperbelt, in this admittedly unbalanced economy, is therefore clearly of the utmost importance.

Thermal power stations, fed with coal from Wankie colliery, have previously supplied the Copperbelt,* but the opening of new mines and inadequacy of coal supplies have combined to demand alternative power sources for Northern Rhodesia. A scheme was planned on the Kafue river, entirely within Northern Rhodesia, but was strongly opposed by Southern Rhodesia, whose rapidly growing power needs urged joint Federal action the better to meet high demand in the shortest time in the most economical way. The copper companies have meantime had to arrange to buy power (50 MV annually from 1957 to 1962) from the Belgian Congo. However, the precariousness of this situation and the significance of Kariba to the Copperbelt are already amply demonstrated. Drought in the Katanga threatens the withdrawal or reduction of Congo power and, pending the arrival of Kariba power, increased thermal generation and expanded coal production at Wankie are making good the deficiency. Because of these urgent demands, the Copperbelt will receive all the power from the first two generators installed at Kariba.

In 1961, with the completion of two more sets, supplies to Southern Rhodesia will begin. There a rapid increase in both African and European population and the development of new industries, vital to the general economic progress of the country, have already created new demands. New industries include a fertilizer factory near Salisbury, meat canning and fruit and vegetable processing at West Nicholson, sugar refining at Bulawayo and Salisbury, textile and clothing manufacture at Bulawayo, Gatooma and Salisbury. These developments have a two-fold importance. The supply of fertilizer fosters agricultural improvement on European and African farms alike; while the provision of employment for Africans relieves the land of surplus population and prepares the way for the establishment of good African farmers as master farmers on the land.

The cost of the first stage of Kariba (6 sets of generators in operation by 1963) is estimated at £80 million; of all 12 sets, to the installed capacity

* See maps in "The Copperbelt of Northern Rhodesia" by R. W. Steel, *Geography*, vol. xlii, 1957, pp. 83–92.

of 1200 MW, a total of £113 million. Such expenditure must necessarily impose a strain on a young country like the Central African Federation; indeed, a large proportion of the finance for the first stage has come from sources outside the Federation:

| | £ million | Per cent |
|---|---|---|
| Federal Government | 5·4 | 6·7 |
| British South Africa Company | 4·0 | 5·0 |
| Banks | 4·0 | 5·0 |
| Copper Companies | 20·0 | 25·0 |
| Commonwealth Development Finance Company | 3·0 | 3·8 |
| Colonial Development Corporation | 15·0 | 18·7 |
| International Bank for Reconstruction and Development | 28·6 | 35·8 |

(The United Kingdom contribution totals 35 per cent)

However, the building of the scheme has stimulated considerable industrial developments within the Rhodesias (notably in the iron and steel and cement industries) and has provided work for people from all the territories in the Federation. Many of the Africans, employed in unskilled or semi-skilled work, have learned a trade which they may turn to account later. Many also have learned something of hygiene and medical care through the facilities necessarily provided on a scheme of this size under the gruelling working conditions that existed.

*The resettlement of the valley dwellers*

The hot and remote valley of the Zambesi in the Gwembe trough was inhabited by the Valley Tonga and We people, who were amongst the most backward in Africa. While the Kariba project brought employment to many Africans, the flooding of the valley has meant the displacement and a new life and economy for the 51,000 who lived there.

Before 1947 these people had been virtually untouched by Western civilization; they were primitive in the extreme. Living in villages scattered along the river banks, they grew crops in pockets of alluvial soil each year after the floods had passed. They had numerous sheep and goats but in most areas the existence of tsetse fly precluded cattle keeping. Although they were a riverine people, the rapid waters of the Zambesi had discouraged the use of the river either for fishing or for transport. Their dress consisted of beads and goatskin aprons.

In 1947 the opening of a district administration office on the northern side of the valley led to the gradual breaking down of their isolation by slow and peaceful progress: a network of dry weather tracks was opened up, improvements in agricultural methods and medical supplies were introduced, schools were started, all with the co-operation of the district chiefs and councillors. Upon this scene of developing enlightenment burst the news of the plans for the new dam and the lake—a bewildering shock for the Valley Tonga and We people who understandably doubted man's power to tame the Zambesi.

Preparations for their resettlement took two courses, the investigation of new areas, and the explanation of the plans to the people. Teams of

government officers on both sides of the river surveyed soil, vegetation and water resources, and tsetse fly infestations. At the same time, the Rhodesian governments enlisted the aid of the chiefs and headmen in selecting new village sites, explaining the situation to their peoples, and introducing new agricultural methods, new crops, boat building and fishing.

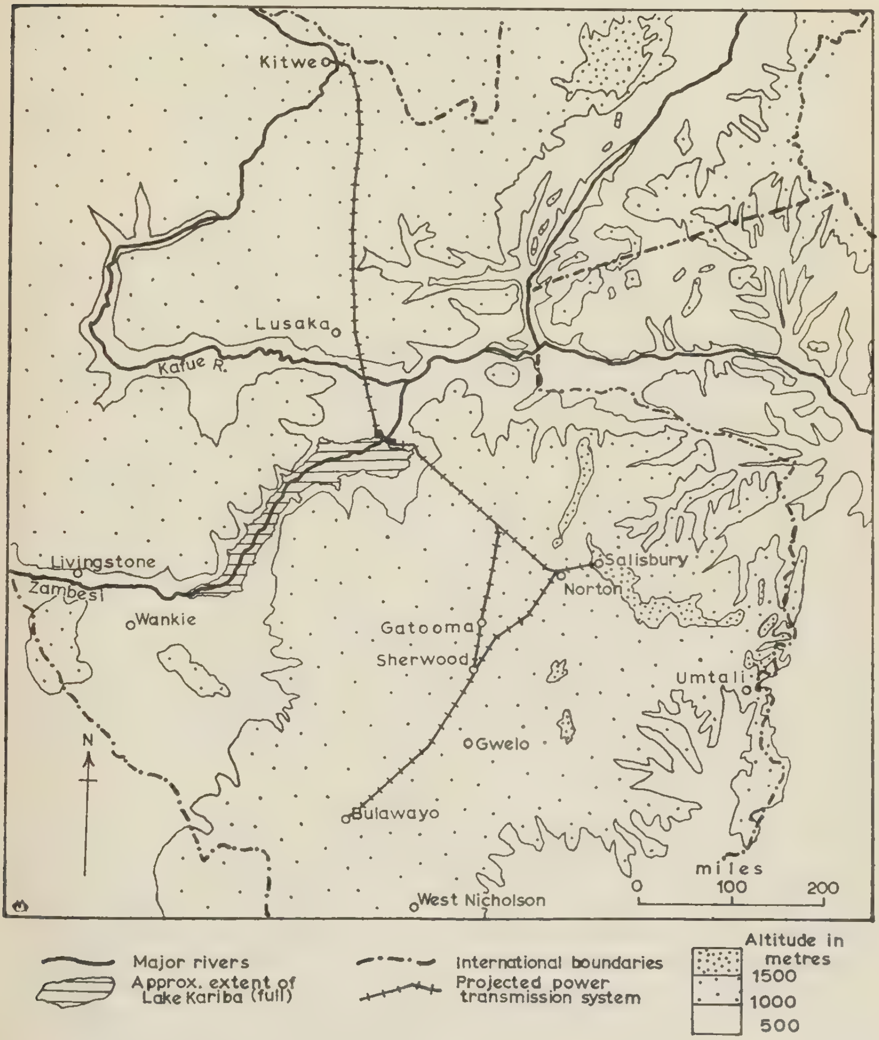


Fig. 2.—The position of Lake Kariba and the power-station site in relation to Northern and Southern Rhodesia. The Zambesi river is the boundary between the two countries.

Areas of good and suitable land within the Zambesi basin proved to be very limited in extent, this shortage being one of the greatest difficulties encountered in the resettlement. Away from the river water resources were inadequate and opportunities for irrigation in the area were negligible, although the damming of some small streams has been undertaken. Citrus

fruits, pineapples, bananas, sugar cane and vegetables, all grown by irrigation methods, have been introduced on experimental plots and it is hoped that, later, the presence of lake Kariba may result in a higher rainfall on the escarpments and a more regular flow in the streams, which are at present intermittent, thus allowing an extension of irrigated cultivation.

The migrations were made, as far as possible, village by village, sometimes as far as 160 miles, for instance for the 560 inhabitants of Mwembe to Masuku in Choma area. In Southern Rhodesia some were given new land on an irrigation scheme recently established at Nyamaropo, north of Inyanga. Boreholes, wells and some schools were established before the moves and interim arrangements were made for food supplies and help with land clearing and housing until first crops were produced. Compensation money encouraged the purchase of agricultural implements and, in the tsetse-cleared areas, of cattle.

By the end of 1958, 29,000 in Northern Rhodesia and 22,000 in Southern Rhodesia had been resettled, before the lake waters started to rise, on the whole a smoothly organized procedure. In Northern Rhodesia, shortage of land, involving overcrowding and political agitation have led to difficulties; the cooler climate and infectious diseases in some resettlement areas have also affected the migrant villages. Some of these problems have necessitated further wholesale moves, in efforts to solve the difficulties of unsettled villages, difficulties which have their beginnings in unexpected ways—unwitting garbage contamination of wells by people accustomed to use river water for drinking, poisoning from the use of previously unknown leaves or fruits for relishes, possible deliberate contamination by political agitators to exploit the weaknesses of backward people whose life has been suddenly—and fundamentally—disturbed. One of the most remarkable features of the Kariba project has, nevertheless, been the way in which the majority of the people have adapted themselves to the new conditions and new opportunities and are beginning to appreciate the benefits of education and medical care. They are quickly learning new agricultural techniques and take readily to fishing as the lake waters spread and reach the new villages.

*Kariba in perspective*

This enormous project must be considered in the light of its contribution to the general economic development of the whole Central African Federation and all of its peoples. The provision of power for the Copperbelt and the midlands of Southern Rhodesia at a cost approximating to the annual value of the output of copper alone must surely be regarded as a sound investment. Power availability will undoubtedly generate a number of industries within the Federation which will aid its material progress and provide work for unemployed or underemployed Africans. In spite of difficulties, the African resettlement scheme has provided a higher standard of living and new opportunities for the people of the Gwembe valley. The development of a fishing industry on the lake, for which harbours are planned, will add a valuable source of protein to the diet of Africans throughout the Rhodesias.

Kariba dam itself will be one of the most spectacular features in Southern Africa and, with the planned development of national parks and game reserves, will attract tourists from all parts of the world.

Already the tempo of development which the Kariba project has generated suggests that Kariba power production will be insufficient to meet demands, and that, as it nears completion, the Kafue scheme will have to be started.

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## CONSOLIDATING LAND HOLDINGS IN KENYA

Schemes for land consolidation have recently been carried out on many of the Native Reserves in Kenya's Central Province. The object is to create conditions for better farming and so to increase the output of food-stuffs in an area already seriously threatened with over-population. The tribal customs in land tenure vary amongst tribes, but all have resulted in owners of land frequently being obliged to cultivate many scattered fragments, and, normally, native customary law offers no security of tenure. The provision of each man with his own consolidated holding and full legal title to it makes for more efficient farming in many ways and for easier development of modern agricultural methods.

In Central Province the actual mechanics of land consolidation had to be carried through scrupulously fairly and with the utmost regard to land-holders' feelings. Several methods were used, one of which is described here. In the preparatory stage, many "propaganda" meetings were held to help the people fully to understand the idea of consolidation and to seek their support. Then unit boundaries were chosen, normally following the boundaries of the land of groups of clans, though in some cases these were too small or too large. An ideal unit was found to be of approximately 2000 acres. Each unit had a Committee of Elders publicly selected from the most trusted representatives of the clans within the unit. When this had been done a large public gathering was held to announce that the area was to be consolidated, and that within the next six months all claimants to land should register their claims with the Committee. The Committee then dealt with disputed claims to ownership, many of great antiquity.

This was followed by the demarcation stage of new holdings. Teams measured on the ground the areas of every fragmentary holding in the unit and recorded the size of each and the owner's name. There followed a thirty-day period in which land-holders could examine the register of land acreages and put forward any objections they had to the land with which they had been credited. At this stage the Demarcation Officer's work started, but before he could start to lay new boundaries he had two mathematical figures to calculate. The first was the reconciliation factor, a mathematical factor to bring the acreage on the 1 : 2500 Air Survey map he would use into agreement with the less accurate acreage totalled on the ground by the fragment measurers. This discrepancy clearly would vary with the hilliness of the area, and the factor was only to correct measuring inaccuracies. In his second calculations, he set aside a percentage for communal purposes, selected by the Committee for roads, schools, cemeteries and so on. The total of the two figures usually amounted to a subtraction of perhaps twelve per cent from the total of fragments measured, but rarely involved an actual loss of land greater than eight per cent. The total percentage cut was applied to every land-owner's total acreage and the Demarcation Officer, as advised by the Committee, relaid holdings on

his (air survey) map with a planimeter to be equivalent to the aggregate of each man's former fragments. The Committee were responsible for seeing that the owners of, for instance, stone houses or valuable plantation crops, were not moved except in absolute necessity. A Survey Assistant followed the Demarcation Officer transferring his map boundaries on to the ground. Boundary hedges were at once planted to ensure a permanent record on the land.

At the same time in District Headquarters a register of all the new holdings was compiled to show owner, acreage and identification particulars. This gave each man an actual title to his land and hence the security necessary to encourage the expenditure of capital in permanent improvements to his new farm.

The work of the Committee, however, was not yet completed, for as the owners moved on to their new lands to start cultivating, the Committee went through the complicated process of assessing compensation for crops left in situ by their former owners. In this follow-up stage agricultural instructors and health advisers are amongst the specialists available and anxious to help the newly established farmer. Agricultural Shows are a growing feature of life in the Reserves to-day.

Owners of over a certain minimum acreage are now moving their homesteads to their own farms and the present villages are being re-planned to accommodate the landless and those who own merely allotment-sized holdings.

Although this "agrarian revolution" caused temporary upheaval and, in some cases, hard feelings, land consolidation schemes can now be seen in the more advanced areas to be quick to bring the advantages that were forecast.

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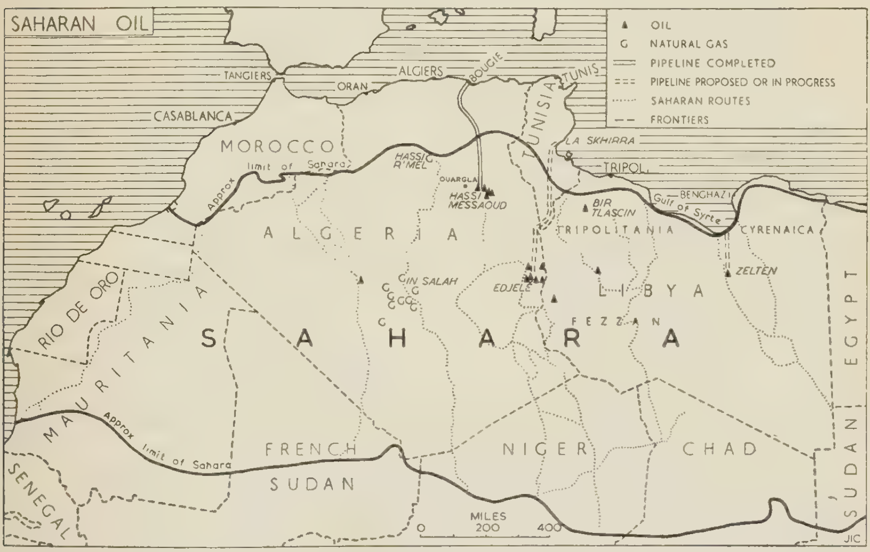
## SAHARAN OIL

The arduous and costly search for Saharan oil dates only from 1952, yet during the fifties well over £500 million were spent in prospecting and development work in the Algerian Sahara alone.

The two major Algerian oilfields were discovered in 1956. The first is at Hassi-Messaoud, 60 miles from the oasis of Ouargla and more than 400 miles south of the reconstructed Mediterranean port of Bougie, to which it is now connected by 24-inch pipeline. The reserves at Hassi-Messaoud are estimated as high as 500 million tons, exploited already by over 50 wells. Exports began in January 1958 by small pipeline and railway, but now it is expected that the big pipeline, laid down at fantastic expense and inaugurated on 5th December 1959, will transport 10 million tons in 1960 and 14 millions p.a. by 1963. The other oilfield usually known as Edjelé is located along the Libyan frontier, 300 miles southeast of Hassi-Messaoud across the immense sand sea of the Grand Erg Oriental. In this field the deposits are widely dispersed, and apart from the main centre at Edjelé important strikes have been made at Tinguentourine, Zarzaitine and El Adeb Larache. Moreover, in contrast to the Hassi-Messaoud oil which lies between 10,800 and 12,800 feet deep, the oil in the Edjelé field is shallow, between 1400 and 4750 feet deep. Pipeline connection with Hassi-Messaoud

would present insuperable difficulties and so, after protracted negotiations with the Tunisian government, work has begun on another 24-inch pipeline from Edjelé northwards 450 miles to a new oil port at La Skhirra on the Gulf of Gabès in Tunisia. Exports are not likely to begin before late 1960, but should soon rise to a capacity of 12–13 million tons per annum.

These two oilfields are of tremendous importance to France. Their combined annual production should exceed 20 million tons by 1963, in comparison with the present French annual consumption of 24–25 million tons. Therefore they will reduce France's dependence on Middle Eastern supplies and save foreign exchange. It is not surprising that French state-owned oil companies dominate the scene. Nevertheless, the gigantic investments involved have necessitated the encouragement of foreign interests, among whom those of the Royal Dutch Shell and Standard Oil of New Jersey are prominent, but foreign companies are required to enter into joint agreements with the French companies.




The marketing of the oil will not be easy. Geographically Saharan crude has a great advantage over Middle East oil for supplying Europe, but it contains an abnormally high ratio of light and middle fractions to heavy fuels, and is thus more suitable for gasoline than for fuel oil, for American requirements than for those of Europe. Moreover, the nationalist attitude of the French government, which desires preferential treatment for Saharan oil within the common market, means an inevitable clash with the international oil companies.

The Algerian Sahara is also rich in natural gas. The principal discovery was made in 1957 at Hassi-R'Mel, near Ghardaia and about 280 miles south of Algiers. Reserves are said to be 800 milliard cubic metres and future annual production may rise to 50 milliard cubic metres, more than the equivalent of the total annual coal production of France. More remote pockets of gas are found south of In Salah at Djebel Berga, Djebel Thara

and Tibaradine, nearly 600 miles from the coast. At the moment investigations are taking place into the problems of marketing, refining and transportation of the gas, but it is certain that here is an invaluable source of power for future Algerian industrialization.

In the neighbouring United Kingdom of Libya, where American (75 per cent) and British (15 per cent) oil interests outweigh those of French companies (10 per cent), activity is more recent. Many important strikes have been made by different companies in various parts of all three provinces (Tripolitania, Cyrenaica and the Fezzan), and some authorities believe that Libya has greater oil reserves than Algeria. The principal strike so far is at Esso Libya's Zelten wells, 200 miles south of Benghazi in the El Agheila region. Esso Libya have plans for an oil terminal and loading point on the Gulf of Syrte, at Mersa Brega, to be linked with Zelten by a 100-mile 30-inch pipeline. Other important discoveries have been made by Gulf at Emgayet, 200 miles south of Tripoli, by Shell at Bir Tlascin, 129 miles south of Tripoli and by Oasis in the region of Syrtica. Announcements of fresh oil strikes appear regularly in the press, but they are not easily evaluated as so many prove to be commercially unexploitable.

The successes in the oil search and the announced 50 : 50 division of profits between the State and the oil operators have raised the hopes of the inhabitants of these vast desert territories. It has long been realized that agricultural developments can only nibble at the problem of raising the standard of living. Oil, gas and industries are the main hopes for future betterment, and form the basis of the economic and social development schemes of the *Organisation Commune des Régions Sahariennes* (O.C.R.S.), founded by the French in January 1957 and including not only the Southern Territories of Algeria but also the Saharan territories of Chad, Niger, French Sudan and Mauretania. Unfortunately, industrialization meets with three other major difficulties: water-supply, transportation and labour-supply. However, the first has been alleviated by the discovery in the Albian strata of a rich and extensive aquifer, which has helped to resuscitate the dying oasis of Ouargla.

The political implications of Saharan oil are numerous. The following three questions are especially pertinent. How long will France control Algeria? As Morocco and Tunisia have only small Saharan territories, will Algerian oil be a barrier to the political unity of the Maghreb? At the moment Saharan oil is free from the control of Egypt, but if it affects Suez tanker traffic will the U.A.R. cast covetous eyes on Libyan oil? These Saharan riches may be the cause of new political groups among the countries peripheral to the desert.

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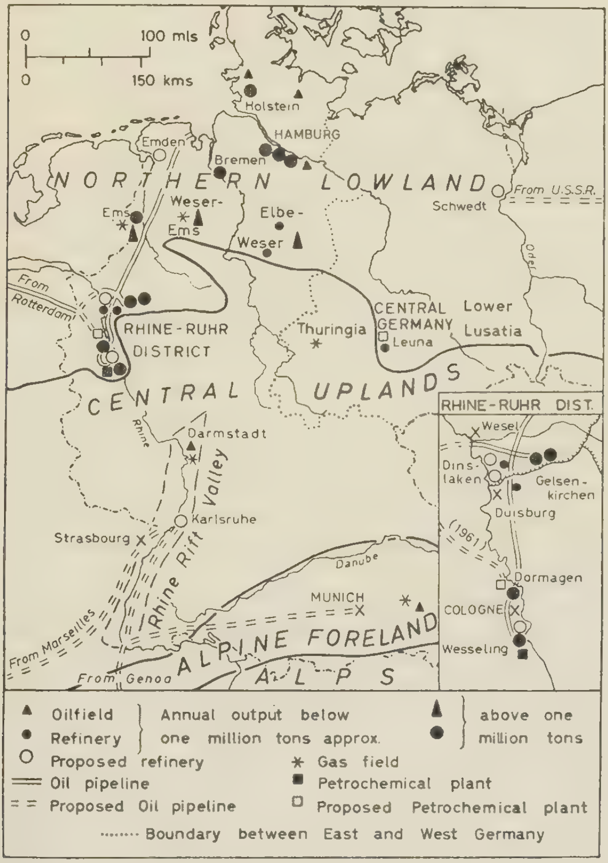
## OIL IN GERMANY

West Germany is the largest oil producer, and one of the largest producers of natural gas, in western and central Europe, although by world standards her annual output of about 4·4 million tons of oil is small. The principal deposits so far discovered are in the Mesozoic sediments of the Northern Lowland, where *Land* Lower Saxony provides about 85 per cent of total oil production. The oldest and largest field of the Northern Lowland lies

between the Weser and the Elbe, where oil was first discovered trapped on the flanks of salt domes. Then 1945 saw the discovery of another group of oil and gas fields of almost equal importance in the Emsland, continuing the Schoonebeek deposits of the eastern Netherlands. Gas is piped to the synthetic rubber plant at Hüls, in the north of the Ruhr. More recently, oil and gas fields have been discovered between the Ems and the Weser, so that it now appears that the main West German oil deposits form a fairly continuous belt running from the Netherlands frontier parallel with the northern edge of the Central Uplands until the boundary with East Germany is reached.




The remaining two producing areas are based on accumulations of Tertiary deposits. Wells in the Rhine Rift Valley near Darmstadt mainly produce gas, which is pumped to chemical plants at Darmstadt, Ludwigshafen and Frankfurt. Gas predominates also on the Alpine Foreland.

German home oil production meets less than one-quarter of requirements, so that the balance must be met by imports. Before 1939, imports mostly took the form of partially or fully refined products. After 1945, West Germany, like other consuming countries, preferred to import crude oil for home refining. The great international oil companies established

their refineries at port locations, like Hamburg and Bremen, where the crude oil could be discharged directly from tankers.

The most original postwar development has, however, been the rise of refining in the Rhine–Ruhr region, in part using the sites and equipment of the uneconomic wartime plants built to produce oil and chemicals from coal. These predominantly German-owned plants deviated from the world tendency to locate the refining of imported oil at the coast. The Rhine–Ruhr plants were, however, able to receive crude oil by barge from Rotterdam, and had the advantage of being in the country's largest market. Postwar Germany thus had the peculiarity among western nations that about half its oil refining was done by German firms, not by the international companies, and predominantly at inland locations, whether on the home oilfields or in the Ruhr.

More recently, the international companies have evidently found their existing refineries too cut off from the main centres of consumption by the thinly populated Northern Lowland, and, following the German trend to a market location, are undertaking great new refinery projects on the Rhine, in part in association with the rising petro-chemicals industry. The attraction of the market has been crowned by the fact that the quantity of oil required is now so great that it is economic to bring it by pipeline from the coast. Already the rapidly growing concentration of refineries and chemical plants in the Rhine–Ruhr region has been reached by pipeline from the north German port of Wilhelmshaven, while a second line from Rotterdam is nearing completion. Each line is planned to have an ultimate capacity of 20 million tons a year.

Meanwhile the important population clusters of southern Germany remain quite distant even from the Ruhr refineries. There is accordingly a joint project of a number of firms to build a refinery at Karlsruhe, on the upper Rhine. This will be supplied by the pipeline which the French are to build from Marseilles to Strasbourg, so that one day Saharan oil may flow into Germany. The same refinery should also be reached by an extension of the proposed Italian pipeline from Genoa to Switzerland, which may also have a branch to Munich. The latter city is the target of a more shadowy proposal for a line from the head of the Adriatic across Austria.

East Germany also is joining the world-wide movement towards the increased use of petroleum. The great Leuna works is to have an extension to produce chemicals from petroleum products, rather than from brown coal. A pipeline will bring oil from the U.S.S.R. to a refinery with an ultimate capacity of 5 million tons, which is to be built at Schwedt on the Oder. East Germany has not been fortunate in its search for oil, but there is evidently some possibility of gas supplies, since the East German press recently carried reports of a great well fire in Thuringia, caused when gas discovered during drilling operations ignited.

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## CHANGES IN THE DURANCE VALLEY

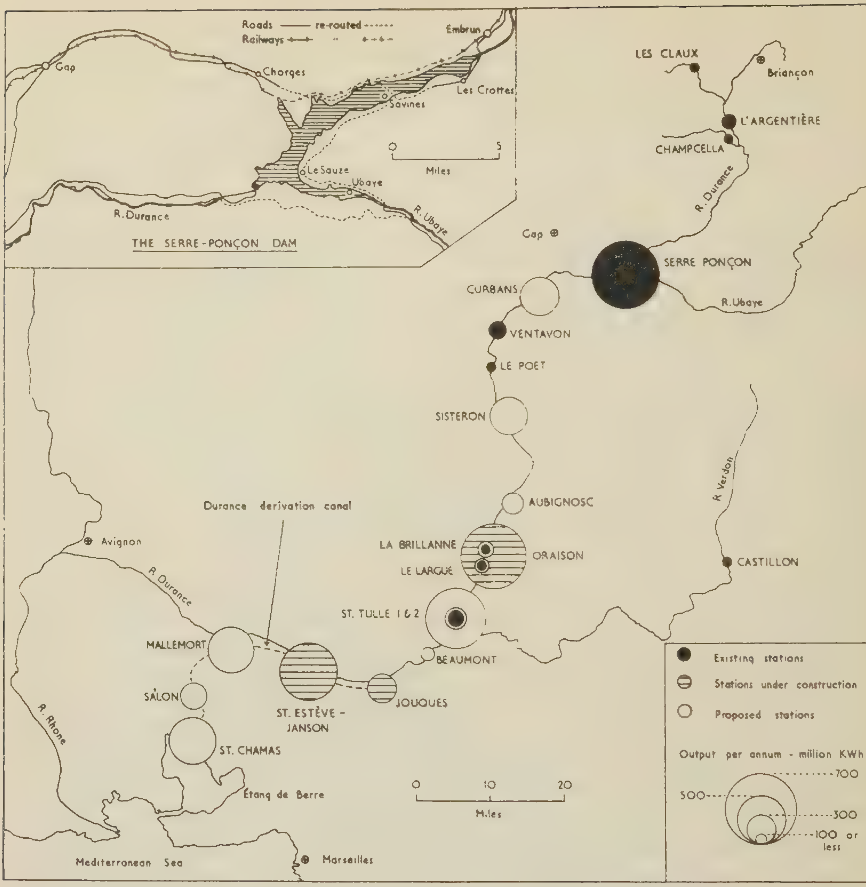
The river Durance rises in the French Alps about five miles east of Briançon and within a short distance of the Franco-Italian frontier. It flows

first southwards and then westwards for some 218 miles to join the Rhône at Avignon. The impermeability of the greater part of the bed in which the river flows, and the characteristic heavy precipitation of the region, contribute to making the Durance a torrential and capricious river, the flow of which varies from 30 cu. m. per sec. at times of low water (winter and summer) to a recorded maximum of 6,000 cu. m. per sec. in times of flood (spring and, especially, autumn).

This high variation of flow has caused disastrous floods and droughts in the valley, and for more than a hundred years engineers have been searching for a method of controlling the river. In the early part of the present century several small water-level power-stations were built, and since 1950 the Castillon dam has regularized the flow of the Verdon; but it was not until 1955 that intensive research carried out over a period of years culminated in parliamentary approval of a comprehensive control scheme for the Durance to provide flood protection, and water for irrigation and urban consumption, as well as for power generation throughout the year. The first two stages of this scheme are now being carried out simultaneously by the national authority *Electricité de France*; they involve the building of a dam and hydro-electric power-station at Serre-Ponçon, near Gap, and the diversion and canalization of part of the waters of the lower Durance.

The Serre-Ponçon dam, completed in November 1959, is situated in a narrow gorge immediately below the confluence of the Durance and the Ubaye. Fluvio-glacial gravels and alluvium, infilling a pre-glacial gorge to a depth of 300 feet, rendered impossible the construction of a concrete dam based on rock, so the barrage, which is 360 feet high, 1,500 feet long and 1,950 feet wide at its base, has been built of earth-fill with an argillaceous watertight core—a unique method of construction for a dam of such proportions. A power-station sited at the foot of the dam will produce 700 million kWh annually. The Serre-Ponçon reservoir, now filling up, will have a maximum volume of 1,200 million cu. m., and is thus more than twice the size of the Bort reservoir on the upper Dordogne, previously the largest in France. On the middle Durance, between the Serre-Ponçon dam and the confluence with the Verdon, there are already five water-level power-stations; the regularizing effect of the dam on the flow of the river will enable their output to be increased, and a further five stations are to be added. Below the confluence with the Verdon it is proposed to divert 250 cu. m. per sec., not required for irrigation or urban water-supply, into a canal running parallel to the southern bank of the river as far as Mallemort, and thence via the Col de Lamanon (used by the Pleistocene Durance, which formed the Crau as its delta) into the Etang de Berre, which is connected to the open sea by the Etang de Caronte and to the port of Marseilles by the Rove canal tunnel. Five large water-level power-stations are to utilize the water of the derivation canal, two of which, at Jouques and Saint-Estève-Janson, are already under construction.

The river Durance, with its tributaries, thus constitutes one of the best potential sources of hydro-electricity in France. The Serre-Ponçon and lower Durance schemes will together produce some 2,900 million kWh annually. Some twenty other power-stations are planned for the upper and middle Durance and their tributaries, and eventually the whole system will represent an addition of about 24 per cent to the present total French output of




hydro-electricity. Other advantages of the scheme include the provision of more reliable and more extensive supplies of water for irrigation, which will allow an increase of 30 per cent in the area irrigated from the Durance in the departments of Vaucluse and Bouches du Rhône, and may help to stabilize agriculture and check the rapid de-population which has been a feature of the higher parts of the valley for some time. Further, it is hoped that the abundance of power will stimulate industrial development, and that the frequently precarious water-supply of Marseilles will be assured.

Several difficulties have attended the construction of the Serre-Ponçon dam; two small towns, Savines and Ubaye, have been evacuated and re-sited, roads and railways have been re-routed, and small barrages have been built into the artificial Serre-Ponçon lake to preserve good agricultural land belonging to villages not themselves submerged. A more important problem is the possible interruption, due to a lowering of the water-table, of supplies of irrigation water to the intensively cultivated plains of the lower Durance. These supplies are derived partly from canals fed directly from the river, and partly from groundwater the relationship of which with the Durance has been the subject of intensive investigations. *Electricité de France* have, however, as part of their contract, devised methods of artificially

feeding these water-courses should they be adversely affected by the diversion of part of the river.

Hydro-electric Power Stations on the Durance

| *Site* | *River* | *Installed capacity kW* | *Production kWh (millions)* | *Date of completion* |
|---|---|---|---|---|
| La Brillanne | Durance | 13,500 | 90 | 1908 |
| L'Argentière | ,, | 52,500 | 159 | 1909 |
| Ventavon | ,, | 38,000 | 186 | 1909 |
| Champcella | Biaisse | 9,200 | 22 | 1910 |
| Le Largue | Durance | 9,000 | 40 | 1915 |
| St. Tulle | ,, | 50,000 | 153 | 1921 |
| Le Poet | ,, | 27,200 | 97 | 1927 |
| Les Claux | Torrent d'Ailefroide | 9,200 | 34 | 1932 |
| Castillon | Verdon | 48,000 | 78 | 1950 |
| | Total: | 256,600 | 859 | |
| *The Serre-Ponçon Dam* | | | | |
| Serre-Ponçon | Durance | 300,000 | 700 | 1959 |
| *The Lower Durance Scheme (to be completed)* | | | | |
| Jouques | Durance | 55,000 | 306 | |
| St.-Estève-Janson | ,, | 120,000 | 603 | |
| Mallemort | ,, | 90,000 | 463 | |
| Salon | ,, | 80,000 | 273 | |
| St. Chamas | ,, | 140,000 | 475 | |
| (others) | ,, | 15,000 | 80 | |
| | Total: | 500,000 | 2,200 | |

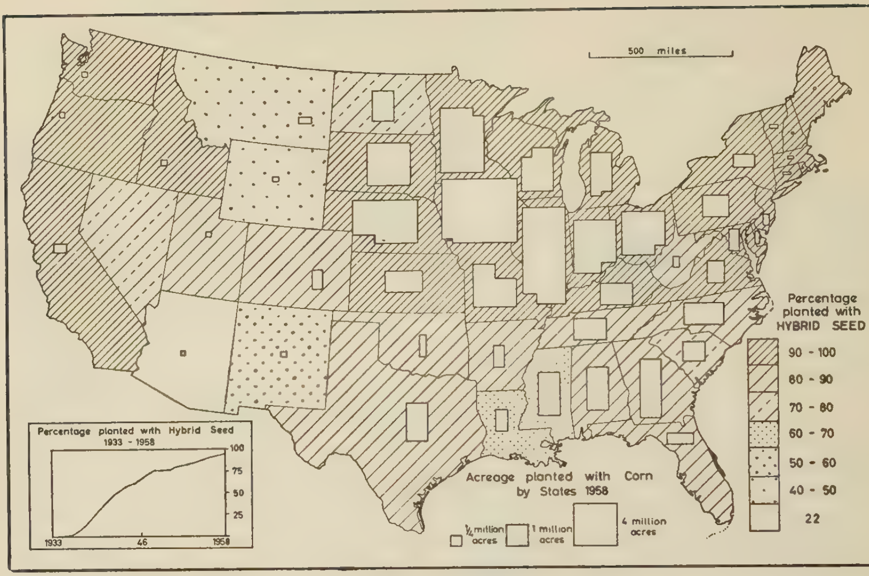
The far-reaching changes which these schemes entail in the Durance valley are not easy to foresee. The problem has been initially considered by the Durance Valley Development Commission, which reported in 1953 on the present economic condition of the region and on the possibilities of agricultural and industrial expansion. Since the publication of the report the hydro-electric developments have rapidly progressed, but the full extent of changes in the valley will not be apparent for several years.

*University of Edinburgh* B. S. Hoyle

## HYBRID CORN PLANTINGS IN THE UNITED STATES

Hybrid vigour, imparted to crops by specially bred hybrid seed, is an important factor in modern agriculture and may be illustrated by the case of hybrid corn (maize); starting from small beginnings in 1933, when only 0·1 per cent of the total corn acreage of the United States was sown with hybrid seed, the proportion increased to nearly 15 per cent by 1938 and to almost 94 per cent in 1958. This increase is shown graphically on the inset to the accompanying map.

The map shows the dominance of the Feed Grains and Livestock Region (the "Corn Belt") in corn acreage in 1958. In the optimum conditions of climate, soils and relief which characterize this region maximum yields have for some years been obtained by concentrating on the best seed, itself raised on specialist farms within the region. Other areas relying almost




entirely on hybrid seed are the Northeast and the Pacific states with Idaho, though acreages in these areas are much smaller.

In the south large amounts of corn are grown, principally on small farms for human and animal consumption on the home farm. In these circumstances it has been difficult to improve farming standards generally, but in states such as the Carolinas and Georgia increases in the proportion of corn planted with hybrid seed have recently been between 5 and 10 per cent annually. Only Mississippi and Louisiana in 1958 planted less than 65 per cent with hybrid seed.

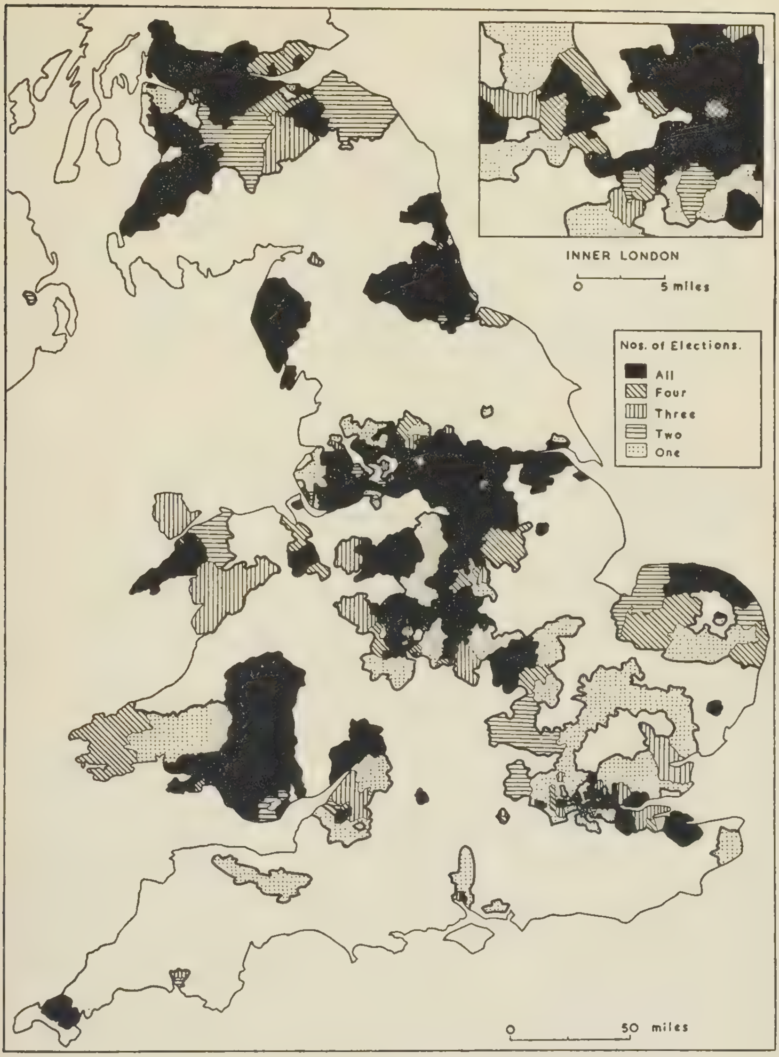
In most of the mountain states of the west only small acreages are grown, and the proportion of hybrid corn is low. In the case of Arizona this is undoubtedly because of the Indian practice of planting local drought-resistant varieties of seed in low-lying land in the hope of adventitious flooding providing sufficient moisture for germination and maturation. Colorado's acreage in the Great Plains has more hybrid seed than would appear from the map; this illustrates the disadvantage of using state boundaries when a given state embraces contrasting physiographic or other significant features. In general the map presents a fair picture of the national distribution of corn growing; the backwardness of some areas, concealed by the figure of 94 per cent of the national acreage planted with hybrid seed, is clearly demonstrated.

(Statistics by courtesy of the Crop Reporting Board, Agricultural Marketing Service, U.S. Department of Agriculture.)

*University of Southampton* D. C. Large

## LABOUR CONSTITUENCIES IN THE UNITED KINGDOM SINCE 1945

The decrease of Labour parliamentary seats from 397 to 258 is in most cases shown chronologically by the map symbol. However, in Scotland




Labour constituencies in the United Kingdom since 1945.

(where three Labour burgh seats and the Western Isles lie outside the map) several constituencies have alternated in their allegiance, as has Belfast W.; and two more constituencies than in 1945 are held today in Wales. Much of Labour's 1945 holding closely matched the "hourglass" denser population belt and outlying conurbations across England, but Norfolk-Lowestoft was a special rural case. The solid blocks were broken occasionally by non-Labour dormitory suburbs in the southwest of large cities.

Half the decrease came in 1950, when two-thirds of the losses were on the rural or residential fringe of the southeastern "hourglass" lobe and one-quarter around the northwestern lobe. Subsequent elections each produced a net loss of 23 seats. In 1951, the loss was evenly spread; but in 1955 there was particular wastage in the northwestern lobe, among

county boroughs with more than one division each, where the residential-commercial or less industrialized seats fell. The decline in 1959 reached alike to industrial constituencies and inner suburbs in London; and in Bristol, the West Midlands conurbation and County Durham, constituencies of a definitely manufacturing character were lost.

Locationally, the constituencies from which Labour has been ousted have been peripheral almost without exception. The cores of the 1945 blocks remain relatively staunch. The earliest and heaviest loss has been in southeast England, where the lobe has been reduced to east London and detached Thames-side industrial seats. In the northwestern lobe and Northumberland–Durham, over half the 1945 seats have been retained. In Wales and Scotland combined, the holding is numerically the same as in 1945.

*University of Reading* P. D. Wood

## ELECTRICITY AND INDUSTRIAL DEVELOPMENT OF THE IRISH REPUBLIC

Since the partition of Ireland in December 1921, successive governments of the Irish Free State have pursued a policy of fostering industrial development, which has necessitated expansion in electrical generating capacity. At the time of the partition, and for some years afterwards, the production of electricity in the Republic was very small, only 78·5 million kWh of electricity being generated in 1928, mainly in the large coastal towns. No inter-town grid system then existed and as most power stations used imported coal or oil, generating costs were high. By 1959 annual generation had increased to 1898 million kWh, largely through the prosecution under state control of a national programme of power station construction. Electricity supply had been extended to all the towns, to most of the villages and to many purely rural areas, through the erection of a national grid (over 38,000 miles of rural line have been erected since 1947). Because of increased electricity consumption and the vigorous exploitation of native resources of water power and peat for electricity generation, the cost per unit has been reduced.

The fuels and resources used by the Electricity Supply Board for its total output are:

| | |
|---|---|
| Water power | 42·7 per cent |
| Imported coal and oil | 34·9 per cent |
| Milled peat | 11·9 per cent |
| Sod peat | 9·4 per cent |
| Native Irish coal | 1·1 per cent |

Of a total Irish coal production of 200,000 tons a year, some 35,000 tons may be available for electricity generation purposes; the present coal imports total 1,800,000 tons a year. Semi-bituminous coal mined in the Arigna region can be used at Arigna power station (Co. Roscommon) of 15 MW capacity. The use of peat in electricity production has been mentioned in an earlier paper ("Peat fuel production in the Irish Republic", *Geography*, vol. xliii, April 1958, p. 126). A recent development in the use of peat has been in contracting with local inhabitants in areas of under-employment to supply hand-cut peat to small power plants (of about

5 MW each), situated with a single generating unit as near as possible to the peat bogs. It has been possible to integrate the limited output of the four small stations of this type now in commission into the 38 kV network without undue difficulty. Of the 22 generating stations of the Electricity Supply Board, nine are hydro stations (the largest being Ardnacrusha on the Shannon, 85 MW) and 13 steam stations; the total installed capacity (1959) was 688,500 kW.

The expansion in electricity generation since the opening in 1929 of the Shannon power scheme, the first stage in the national power plan, is reflected in changes in the power equipment of manufacturing industry and in the increased demand for purchased power. In the early 1930s power requirements for industrial development had to be met largely by steam engines and internal combustion engines in factories, due to the lack of an adequate electricity distributing network. These prime movers in manufacturing industry have shown little expansion since 1931, however. Instead, industrial development has been largely based upon the installation of electric motors, the capacity of which increased from 63,000 h.p. in 1931 to 265,000 h.p. in 1952; and 225,000 h.p. of the 1952 total was driven by purchased electricity.

Another result of providing a national electricity supply has been the adoption of standard charges throughout the country. For industries using electricity, in a country poor in natural resources, this has offset to some extent the disadvantages of inland locations, so far as power costs are concerned. In this way the dispersal of light industry into the smaller inland towns, an important aspect of official industrial policy, has been facilitated. In 1933 the use of purchased electricity for industrial purposes was slight and was concentrated at the ports. Even by 1939 this pattern had changed, especially in south central Ireland, where the larger market towns quickly benefited from the dispersal policy. Since then the industrial use of purchased power has become widespread: in 1959 the larger ports —Dublin, Cork, Limerick, Waterford, Drogheda and Dundalk—consumed only 48 per cent of the total electricity purchased for motive power; in 1933 they had consumed 70 per cent.

The accompanying maps show—though not precisely, because they indicate only the consumption of purchased electricity and take account neither of other forms of power nor of the different power requirements of the various industries—that the southern midland and the south of the Republic have benefited more than the west and northwest from the availability of electrical power for industry. The southern and midland areas are nearer the main ports, and most of the newly established industries are heavily dependent upon imported raw materials; communications are better developed in central and southern Ireland than in the west and northwest. Moreover, the major ports offer the largest markets for industrial output, while local capital, important in financing new industries in the Irish Republic, is less readily available for investment in industrial development in the poorer northern and western districts.

The distribution of industrial development in relation to power availability has also depended to some extent on the type of power requirements. Cement making is the largest single consumer; the two cement factories, at Drogheda and Limerick, use electric rotary kilns. In general, however,

those industries not requiring heat in the manufacturing process have benefited most from the electrification programme. Flour milling, now

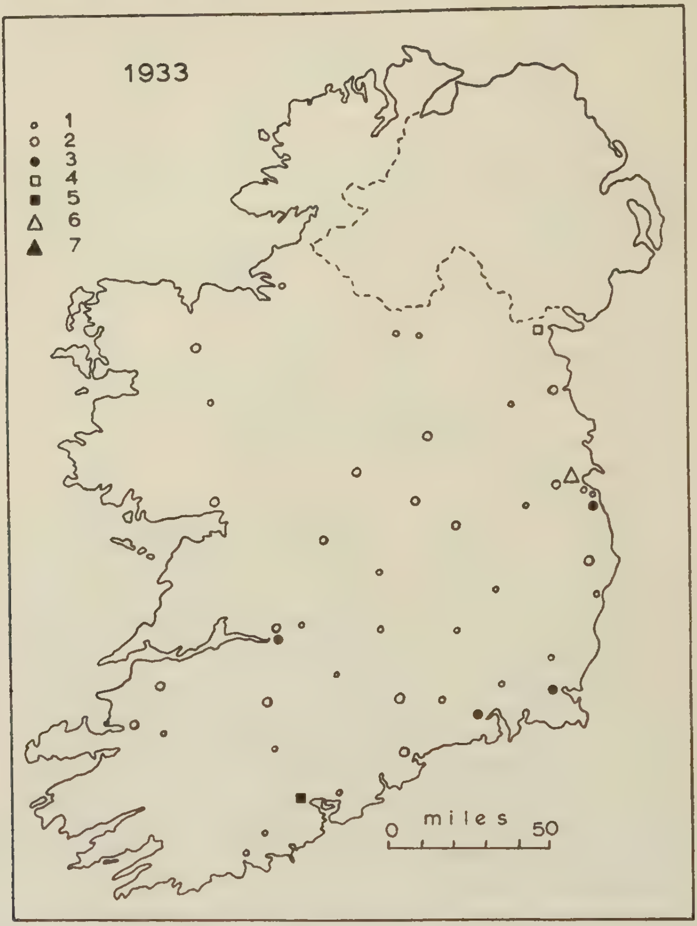



Fig. 1.—Distribution of industry using purchased electrical motive power, 1933. Key: Capacity of motors—1. 100–199 horse power; 2. 200–499 h.p.; 3. 500–999 h.p.; 4. 1000–4999 h.p.; 5. 5000–9999 h.p.; 6. 10,000–49,000 h.p.; 7. over 50,000 h.p. Data from Appendix 1, Annual Report of the Electricity Supply Board, Dublin, 1933.

highly mechanized in a few large units at the ports, the textile and clothing industries and boot and shoe manufacture are the most prominent examples. Brewing, on the other hand, the most important industry in terms of net output, has a relatively slight dependence on purchased electricity; it is dominated by one unit, the Guinness brewery in Dublin, which generates power on its own premises. Steam engines, steam turbines and internal combustion engines are still important as local power suppliers in a few industries, especially in sugar-beet factories at Carlow, Mallow, Thurles and Tuam, and in other food industries—sugar confectionery, jam making, creameries and grain milling—and in mines and quarries.

Although there is still a marked concentration of the larger enterprises in the greater ports, the former industrial monopoly of these towns has broken

before the wide dispersal of light industries among smaller inland towns, an expression of the success of the state plan for national electricity supply.

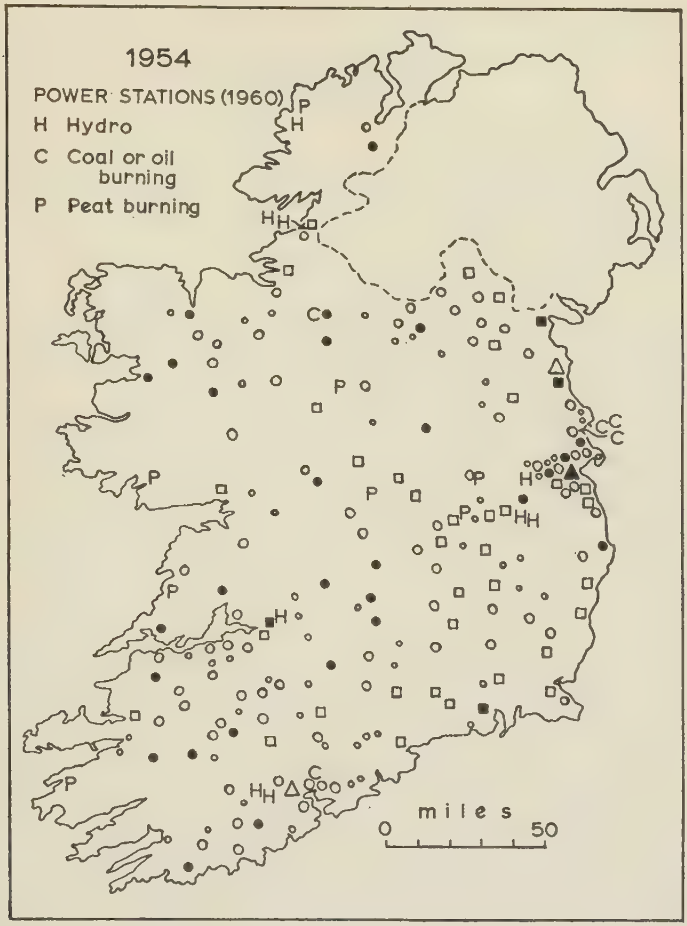



Fig. 2.—Distribution of industry using purchased electrical motive power, 1954, and locations of power stations in 1960. See Fig. 1 for key to capacity of motors. Data from Appendix 1, Annual Report of the Electricity Supply Board, Dublin, 1954 (since which date the method of publishing the statistics on which these figures are based has been changed).

Small units of light industry, based on a nationally available power supply, provide valuable employment opportunities throughout the country and to some extent counter population problems arising from emigration. It remains to be seen whether, in a country like Ireland, there will be a sufficiently increasing national income to promote a demand for more energy and more electrical appliances as part of a normal economic and industrial development. May continuing emigration and the limited natural resources limit further expansion under a successfully applied government industrial policy?

*University of Hong Kong* D. J. Dwyer

# The Training of Geographers

## Report of a Discussion on Specialization in the Training of Geographers and the Teaching of Geography in Schools

The chairman, Professor K. C. Edwards (University of Nottingham), introduced the two opening speakers and hoped that the discussion would help to explain some of the differences between school geography and university geography.

Mr. E. O. Giffard (Educational Adviser to G. Philip and Sons Ltd.) began by clarifying the title. He did not wish to attack specialization in the universities, since he felt that specialization was necessary before research could be conducted in geography or in any other subject. What he did oppose was the tendency in some university departments and also in a number of grammar schools to place too much emphasis on the alleged over-riding importance of one aspect or another of the subject. He was prepared for a refutation of this charge, since it is a characteristic of this tendency that those responsible for it are often largely unaware of its existence. A biased conception of geography is particularly unfortunate in those who go out into the world from a university to teach the "faith" in schools.

A number of departments have acquired a traditional emphasis in their respective geography courses which is inevitably though subtly communicated to the students who proceed to become teachers. Thus a bias in geography acquired by the university student becomes a bias in school geography when it is wittingly or unwittingly handed on to the teacher's pupils. Mr. Giffard said that, when he visited a school, a short conversation with the geography teacher and a glance around the equipment of books and materials in the geography room were often enough for him to guess, with a fair degree of accuracy, the university in which that particular teacher had studied geography. This he regarded as evidence that training in a particular university does in fact often result in a student acquiring a particular concept of the subject, a concept which exaggerates the importance of one or other aspect at the expense of the remainder. This, Mr. Giffard suggested, is undesirable because teachers who have acquired a narrow conception and who in their turn pass it on to their pupils tend to forget the fact that geography is a whole, a synthesis made up of many parts, all of which require balanced treatment in a school course.

Professor R. W. Steel (University of Liverpool) asked why should not geographers feel proud of the tradition in which they had been trained: at the same time, he suggested, we must rid ourselves of the notion that no Oxford geographer could be a physical geographer, or that no Cambridge geographer was interested in the human side of the subject. It was the job of university departments to train geographers, not produce teachers.

➤ The discussion took place during the Annual Conference of the Association in London, on 30th December 1959.

Although departments were not unmindful of the many graduates who eventually became teachers, it would be wrong if their work were specially geared to the needs of the potential teacher of geography.

Most university lecturers were able to pursue specialist lines of research in these days, and they ought to be encouraged to share their interests with their students. It was, however, important that the balance and unity of the subject should be emphasized.

Turning to geography in schools, and in the Sixth Form in particular, Professor Steel suggested that although the enthusiastic, newly qualified teacher would have to put aside much of the subject-matter which he had recently learned in the university, he would be justified in teaching some of his more specialized work, and in so doing would be stimulated by the interest which had been aroused in his mind in the university. Again, the fundamental principles underlying the subject must not be forgotten, and there must be balance maintained between physical and human geography and between the regional and systematic branches of the subject.

One of the tasks of Sixth Form and university teachers must be to work out some mutual understanding so that it would be known what ought to be taught in school (always bearing in mind the many who do not proceed to the university) and what could more profitably be left for consideration later in the university. Some of the overlap was caused by the increasing habit of a third year in the Sixth, which he did not regard as either necessary or desirable, even for those seeking admission to the older universities.

In the discussion which followed the contributions of the above speakers, a number of points were made from the floor of the hall. Dr. Alice Garnett (University of Sheffield) agreed with the assertion that university geography departments are concerned with the training of geographers, not of geography teachers. It is equally relevant that Sixth Form teachers of geography are not solely concerned with pupils who proceed to universities; a balanced and adequate course in geography should be presented to those children who will not study the subject beyond the Sixth Form stage. She referred to a series of questions which in recent years she had put to first-year students upon their entry into the geography department of the University of Sheffield. She was perturbed by the considerable proportion of them who confessed that they knew virtually nothing about many of the continents; large numbers of students had "done" the same major regions, e.g. the British Isles, Europe and North America, for both Ordinary and Advanced levels of the examination. Approximately 60 per cent of those questioned could not provide elementary facts about the geography of Asia, Africa or South America. Could not schools give a wider training in basic geography than this?

Another member suggested that the cause of these extensive gaps in regional knowledge at the end of a Sixth Form course lay in the demands of the examination syllabus, which restricted the number of continents studied for Advanced level G.C.E.

Mr. Cadman (Stratton School, Biggleswade) spoke of the severe competition among Sixth formers to get into university departments of geography and pointed out that gaps in regional knowledge sometimes persisted after a student had completed a university course.

Mrs. Butcher (Highbury Hill High School, London) observed that the examination syllabus usually permitted teachers to take up at Advanced level the study of continents which had not been studied by their pupils at Ordinary level; pressure of work, however, coupled with the understandable desire to obtain the highest possible marks for each pupil, often tempted teachers to select for Advanced level the same continents in which the pupils had already specialized at Ordinary level.

Mr. Searle (Northampton Grammar School) feared that as long as the severe competition for university places persisted the necessity for pupils to get a high A-level mark would force them to stay on for a third year in the Sixth Form especially for entry to the older universities. (At this point the Chairman intervened to refute an implication conveyed in the previous speaker's statement; Professor Edwards said that universities do not necessarily reject a candidate who has not got a very good A-level mark in geography.)

Mr. Walshaw (Northgate Grammar School, Ipswich) felt that a sad feature about school geography is that even to-day many geographers have not had any training in the teaching of their subject. He called for a conference at which representatives of schools and university departments might get together to discuss the problem of the overlap between geography in schools and in universities.

Mr. Starr (City of London School), referring to the regional "gaps", suggested that the pupils who knew next to nothing about Africa at the age of seventeen had probably "done" that continent at the age of eleven or twelve. He therefore advocated a general revision course of the world in the Fifth Form. A later speaker agreed with Mr. Starr on the need for world revision. She had recently returned from a visit to the Soviet Union and had been amazed at the lack of knowledge of Russia amongst the students who made the tour.

Mr. Roberson (Institute of Education, University of London) suggested that the discussion had veered away from the original title; he felt that the possibility of over-specialization in universities might be given consideration.

At this juncture the Chairman had to call upon the two opening speakers to wind up the debate, as the allotted time had been reached, although clearly the meeting could have continued briskly for another hour. Enough had been said, however, to reveal the need for further discussion upon three topics, which persistently recurred in members' contributions:

1. A reconsideration of the geographical knowledge which Sixth Formers ought to possess by the time they leave school.
2. How to achieve a better integration between the geography learned at school and at university, with the elimination of gaps and overlaps between these two levels of study.
3. The restrictions imposed upon the Sixth Form geography syllabus by the intense competition for places in university departments of geography.

L. J. Jay

# Obituary

## GEORGE JOSEPH CONS

The sudden death of Mr. G. J. Cons, M.A., on January 15th, 1960 deprived him of the signal distinction of becoming President of the Geographical Association for 1960–1 and robbed the world of geography of the many publications which he had planned to complete during his years of retirement. Few geographers have made a more varied and influential contribution to present-day methods of teaching the subject in schools.

A graduate of King's College, London, he taught for many years in London and Yorkshire schools before his appointment in 1930 to the University of London Goldsmiths' College, where, at the time of his retirement in 1958, he was Senior Tutor and Principal Lecturer in Geography. There he gradually built up a finely equipped and vigorous department of geography, a unique feature of which was its Third Year Supplementary course for serving teachers who took the Academic Diploma in Geography.

A notable pioneer in the use of film and radio as teaching aids, Mr. Cons supervised the production of over 50 educational films, including the well-known series on British fisheries, types of urban settlement, Indian cities and the daily activities of workers. His abiding interest in his birth-place was well shown in the film *The Growth of London*. *Great Britain's Geographical Position*, in which Mackinder's views on the significance of a situation "of Europe yet not in Europe" were translated into visual terms with the aid of a gigantic globe, was Mr. Cons's last film and the one which gave him most joy to make. In the formative years of school broadcasting he became a member of the Geography Committee of the Central Council and planned several series of geography talks. His own broadcasts, such as the memorable "Emptying the Dustbin", showed clearly how children's innate curiosity in their natural surroundings may be used as a point of departure for classroom activity. This theme was developed in a very influential book *Actuality in School* written in collaboration with Catherine Fletcher.

In textbooks for primary schools, such as *Village Peoples* and *Man's Work in the World*, he helped to popularize special teaching techniques—the seasonal work diagram and the sample study method—and his wallcharts on India, U.S.S.R., Regions of the World and British Farming did much to convince teachers of the value of this form of visual aid. *Geography and the Teaching of International Relations* was an eloquent plea for the view that "one of the aims of the teaching of geography in schools is to lay the foundations of an international mind that sees the salvation of man in the establishment of a world society".

Mr. Cons was known and respected by teachers at every level from the primary school to the university. As a Recognized Teacher of London University he examined and taught Honours and Pass Degree students; he knew many training colleges as an examiner and university visitor; and he was in constant touch with schools of every kind. The aim of the *Handbook for Geography Teachers* which he edited for the University of London Institute of Education in 1955 was to "bring schools, training colleges and university

into a partnership to further the study and teaching of geography" and to "guide teachers in their task of . . . maintaining academic and educational standards".

He worked zealously for the realization of the principle laid down in the McNair Report that training colleges should be closely linked with universities in the task of training teachers. From the time of the inception of the University of London Institute of Education in 1948 he was a member of its Council and Academic Board. As Chairman of its Standing Sub-Committee in Geography he guided the growth of a number of valuable projects involving the co-operation of teachers of every kind, notably in the publication of the *Handbook for Geography Teachers*, *Geographical Excursions in and around London*, and a forthcoming book on the geography of Greater London which he was editing at the time of his death. For the Royal Geographical Society he wrote *Geography and Visual Education* and served for many years on the Education Committee. He worked equally actively on behalf of the Geographical Association, notably as President of the Northwest Kent Branch, Vice-President of the Goldsmiths' College Old Students' Branch and a member of the Standing Committee for Visual Aids. He was looking forward eagerly to his year of office as President of the Association as the culmination of a life-time's vigorous, varied and distinguished service to the cause of geographical education. Geography to him was "capable of achieving a real synthesis between the two conceptions of culture, the humanistic and the scientific, and thus it is helping to close the rift in our culture".

In recording here the loss to the Geographical Association, we would at the same time express our sympathy to Mrs. Cons and her two sons in their bereavement.

G. B. G. Bull

# The Geographical Association

## ANNUAL REPORT 1959

We extend warm thanks to our retiring President, Professor Steers, for his thought and help on our behalf, despite the heavy calls on his time both in this country and abroad, as at the same time we welcome our incoming President, Professor Austin Miller, known to us all for his work both for the Association and for our subject, again in fields of physical geography. We are grateful for the help and time given by our retiring members of council and of the executive committee, and for the continuing devoted labours of our section committees and their officers and our branch officers whose zealous and important work may seem to pass unnoticed. To all who help so effectively to direct forward the affairs of the Association we express our sincere thanks.

Despite high hopes of a year ago, membership just failed to reach our target of 5000 though increasing from 4610 to 4919 (including 889 student members). Currently since September however new members are enrolling in such numbers that we feel confident that we shall pass our target by a very comfortable margin before another Annual Report is written. This is encouraging news, in itself reminding us of the high standing of our subject in the national educational hierarchy, and the great increase in correspondence and work that now literally floods into our headquarters is a measure and reminder of the continuing need for vigilance with regard to the advancement of our subject and the safeguarding of the interests and needs of its teachers in all categories of educational institutions both at home and abroad.

Such growth and progress has not been without domestic repercussions, and staffing and working arrangements at headquarters, brought almost to breaking point, necessitated the spending of some time and money during the year in effecting a major re-organization of the layout of our office and library floor space to cope with urgent and expanding needs. In this re-organization we were greatly helped by a splendid gift from the University of Sheffield of considerable quantities of oak library shelving that has made possible a complete replacement of our existing well-worn furnishing and at the same time gives shelf space for expansion that will be sufficient to meet our needs for many years to come. Whilst this re-organization was in progress information was formally received from the City Librarian's committee regarding the City's need for other civic developments within the next two years of the library space that we occupy. We are grateful beyond measure for the hospitality we have had for so many years but the time has clearly come when we must make provision for a permanent home not dependent on public generosity, and action is already being considered with this in view.

Substantial help towards this end would come from the increase in subscription which Council has recommended, and members are reminded that, provided they obtain and use form P.358, issued by the Inland Revenue (whereby they can obtain a rebate on Income Tax for the amount of the subscription paid) the proposed increase of our subscription from 1 guinea to £2 would in fact represent a net increase of payment of no more than a few shillings for many members. We have already increased the special student subscription rate. This is a matter of real regret, enforced by the increased printing costs which even now are barely met by the new rate.

In yet another quite different respect we have been beset with serious domestic difficulties. Despite extra staffing needs at headquarters it has proved difficult to appoint competent new staff within the salary range that we have felt able to offer. This has meant that for some years the Assistant Secretary and the senior clerk have been without the help they should have. To crown these difficulties, in the past year, the prolonged strike in the printing industry threw the schedule for the publication

of our journal—as of many others—completely out of phase. We have managed to catch up with some of the production through the good offices of our printers, but our main concern now is to restore the appointed time-schedule. To do this we are following the example of several other societies in similar plight and shall issue the first two parts of the 1960 volume as a double number. To the members of the Editorial Board and the many external referees who have assisted the Honorary Editor in his tasks of considering and selecting manuscripts for publication a special word of thanks is due at the end of a year not without its technical complications.

From the troubles evident in the preceding paragraphs let it not be thought however that chaos and despair reign at headquarters. Far from this, our small loyal band of staff, recently augmented by a senior clerical assistant, has achieved quite herculean efforts of re-organization while maintaining routine business activities. We have every reason to assure members that their lot should now be much easier and more comfortable from every point of view.

Our branches, now numbering 56 (including a new one at Southampton) indicate on the whole a fruitful year with interesting programmes of activity. Some are ambitious, as for instance in the organization by the Birmingham branch, amongst other ventures, of highly successful refresher courses for teachers in that region. It is disappointing however to note in how many cases the branches barely include or even fall short of the statutory minimum number of full members (10) for a branch technically to exist, and branch officers are urged to do all in their power to increase the number of full members as at the same time they continue their admirable work for the subject in arranging meetings for local audiences, predominantly composed of associate members or the general public.

The work of the various sections and committees has been vigorous as the following record shows.

*The Secondary Schools Section* has dealt with numerous enquiries from members and others, related to examination syllabuses, textbooks, geography rooms, equipment and other subjects. A memorandum on the N.U.J.M.B. examination in Geography at Advanced Level, submitted by the Sheffield Branch, was approved and, after endorsement by the executive committee, was sent to the Secretary of the Board. Suggestions were made and embodied in the N.U.T. Education and Careers Exhibition held last year. Draft questions and exercises are now being prepared by the committee for issue, it is hoped, as supplements to some of the Ordnance Survey sheet memoirs to be published by the Association.

*The Public and Preparatory Schools Section* has been concerned with the distribution of the two issues of the section's *Notes and Queries*, one of which contained a detailed Preparatory School Geography syllabus much appreciated by members of the section. The Steers essay prize was this year awarded for the essay topic "Local Field Work" which did not prove to be very popular amongst preparatory schools.

*The Primary Schools Section* has been active in discussions on educational visits, the place of school gardens in geography teaching in primary schools, and the study of the teaching of geography to infants by non-specialist teachers. The year has also seen the publication of the new booklet on the teaching of geography in the primary school.

*The Training Colleges Section* has held its usual three conferences during the year, and these have been very well attended both in London and in Chester. The section committee has been very active in collecting material for the publication by the Association of a pamphlet on Sample Studies; it has also prepared a Memorandum now published and in the hands of the Ministry, on the planning and equipping of geography rooms in training colleges; this document has been greatly appreciated and we are much indebted to Mr. Marchant, H.M.I., for his help and support. The committee has also been active (with the Primary Schools Section) in the preparation of the handbook for Junior Schools already noted. The need for and success of this

booklet will be assessed when it is known that in the space of six months 5000 copies have been disposed of through our headquarters, many to training colleges, and the printing of a second edition is already called for.

*The Further Education Section* alone amongst our sections records less vigorous activity. The number and variety of institutions served make it a difficult section to organize. Two committee meetings have been held and a small group attended a weekend section conference at Malvern. The committee has given help and guidance to some newcomers into this field of education, but, regretfully, the publication of the section's bulletin has had to be suspended this year.

*The Executive Committee of Council* has had a busy year, concerned with customary routine business and in addition proposals for the amendment of the syllabuses for Geography of the N.U.J.M.B.; enquiries regarding Television School Broadcasts in Geography, the furtherance of the Association's publications, particularly those referring to work in primary schools, secondary schools, and to sample studies, and to the scheme for a series of special publications related to O.S. one-inch sheet maps. Professor Edwards, editor of this new series, reports very good progress and we hope to have our first booklet on the Lake District sheet available for inspection at the Annual Conference. The executive committee has also negotiated and accepted an offer of two Travel Bursaries in the Commonwealth for teachers of geography who are members of the Association. It is hoped that two nominations will shortly be made for these bursaries, one to be held in Australia and the other in Canada.

During the year we have held a most successful Spring Conference at Leicester and to the Council of the University of Leicester and to Professor Pye and his staff we extend warm thanks for generous hospitality and a very fruitful meeting. Two foreign summer schools were held, one on Alpine Geography directed by Mr. R. C. Honeybone, and one on Mediterranean Geography, in Spain, directed by Dr. J. M. Houston. We are most grateful to the leaders and their staff for all the work that went to the preparation and organization of these ventures.

The year, as can perhaps be assessed from this report, has been eventful, and very active. We look forward in the new year to increasing vigour and hope to be able to report further new ventures and developments of value to our members at a point in our history that may well mark a significant turning in our road.

ALICE GARNETT
*Honorary Secretary*

*December* 1959

# THE GEOGRAPHICAL ASSOCIATION

**BALANCE SHEET** — **31st August, 1959**

| | £ s. d. | £ s. d. | 1958 £ |
|---|---|---|---|
| **Accumulated Fund** | | | |
| Balance at 31st August, 1958 .. .. .. .. .. | 1,133 0 6 | | 681 |
| *Add* Surplus for the year as per Income and Expenditure Account .. .. .. .. .. | 126 5 1 | | 452 |
| | | 1,259 5 7 | 1,133 |
| **General Reserve** .. .. .. .. .. .. .. .. | 1,745 1 9 | | |
| *Add* Balance from Study Courses and Conferences Account .. .. .. .. .. .. | 247 17 8 | 1,992 19 5 | 1,745 |
| **Removal Reserve** | | | |
| Transferred from Income and Expenditure Account .. .. .. .. .. .. .. .. | | 800 0 0 | — |
| **Subscriptions paid in Advance** .. .. .. .. .. | | 883 11 4 | 318 |
| **Sundry Creditors** | | | |
| *Geography* (One issue) .. .. .. .. .. .. | 672 10 0 | | 1,189 |
| Summer Schools .. .. .. .. .. .. .. | 1,166 15 0 | | 163 |
| Sundry .. .. .. .. .. .. .. .. .. | 393 8 8 | | 378 |
| | | 2,232 13 8 | 1,730 |
| | | 7,168 10 0 | 4,926 |
| **Publications Reserve Fund** | | | |
| Balance as at 31st August, 1958 .. .. .. .. | 1,675 14 8 | | 1,623 |
| *Add* Interest for the year .. .. .. .. .. | 54 3 3 | | 52 |
| | | 1,729 17 11 | 1,675 |
| Carried forward .. .. .. .. .. .. .. .. | | £8,898 7 11 | £6,601 |

| | £ s. d. | £ s. d. | £ s. d. | 1958 £ |
|---|---|---|---|---|
| **Accumulated Fund** | | | | |
| **Debtors** | | | | |
| Summer Schools .. .. .. .. | 126 14 0 | | | 214 |
| Sundry .. .. .. .. .. .. | 485 16 7 | | | 566 |
| | | 612 10 7 | | 780 |
| **Stock of Special Publications** .. .. .. .. .. | | 364 9 2 | | 264 |
| **Office Library Furniture and Equipment** | | | | |
| Estimated Value 31st August, 1951 .. .. .. .. .. | 150 0 0 | | | |
| Additions, less Sales, since .. | 1,048 13 7 | | | |
| | 1,198 13 7 | | | |
| *Less* Depreciation to date .. | 325 12 7 | 873 1 0 | | 681 |
| **Investments** | | | | |
| £200 3% Savings Bonds 1965–75 at par .. .. (Market Value 31st August, 1959 £153) | | 200 0 0 | | 200 |
| Cave Austin & Co. Ltd. 1,265 5% Cumulative Preference Shares of £1 each, at cost .. .. .. .. .. .. .. | | 851 13 0 | | 852 |
| North Central Wagon and Finance Co. Ltd. | | | | |
| Cash on Deposit .. .. .. .. | 2,310 1 3 | | | |
| Leek & Moorlands Building Society | 1,241 11 0 | | | |
| Cash at Bank—Current Account | 671 13 3 | | | |
| Cash in hand .. .. .. .. .. | 43 10 9 | 4,266 16 3 | | 2,149 |
| | | | 7,168 10 0 | 4,926 |
| **Publications Reserve Fund Assets** | | | | |
| Duplicator, at cost .. .. .. .. | 32 3 2 | | | |
| *Less* Depreciation .. .. .. .. | 24 13 2 | 7 10 0 | | 8 |
| North Central Wagon and Finance Co. Ltd. | | | | |
| Cash on Deposit .. .. .. .. .. .. .. | | 1,666 18 5 | | 1,667 |
| Cash at Bank—Current Account .. .. .. | | 55 9 6 | | |
| | | | 1,729 17 11 | 1,675 |
| | | | £8,898 7 11 | £6,601 |

**BALANCE SHEET**—CONTINUED

| | £ s. d. | £ s. d. | 1958 £ |
|---|---|---|---|
| Brought forward .. .. .. .. .. .. | | 8,898 7 11 | 6,601 |
| LIFE MEMBERSHIP SUBSCRIPTION FUND | | | |
| Balance as at 31st August, 1958 .. .. .. .. | 3,109 9 2 | | 3,082 |
| *Add* Subscriptions received during the year .. | 81 7 6 | | 27 |
| | | 3,190 16 8 | 3,109 |
| JUBILEE FUND | | | |
| Balance as at 31st August, 1958 .. .. .. | 1,031 12 11 | | 1,001 |
| *Add* Interest for the year .. .. .. .. | 26 18 9 | | 31 |
| | | 1,058 11 8 | 1,032 |
| HERBERTSON MEMORIAL FUND | | | |
| Balance as at 31st August, 1958 .. .. .. .. | 294 16 0 | | 286 |
| *Add* Interest for the year .. .. .. .. | 7 19 3 | | 9 |
| | | 302 15 3 | 295 |
| | | £13,450 11 6 | £11,037 |

| | £ s. d. | £ s. d. | £ s. d. | 1958 £ |
|---|---|---|---|---|
| Brought forward .. .. .. .. .. .. | | | 8,898 7 11 | 6,601 |
| LIFE MEMBERSHIP SUBSCRIPTION FUND ASSETS | | | | |
| INVESTMENTS | | | | |
| £1,646 4 2 3% Savings Bonds 1965–75 .. .. .. .. | 1,646 4 2 | | | |
| £300 0 0 3% Savings Bonds 1955–65 .. .. .. .. .. | 300 0 0 | | | |
| | | 1,946 4 2 | | 1,946 |
| £170 3½% Defence Bonds (Conversion Issue 1964) .. .. .. .. .. .. | | – – – | | 170 |
| £170 5½% Mortgage Loan — Sale Corporation .. .. .. .. .. .. | | 170 0 0 | | — |
| (Market Value 31st August, 1959 £1,532) | | | | |
| | | 2,116 4 2 | | 2,116 |
| Cave Austin & Co. Limited—985 5% Cumulative Preference Shares of £1 each, at cost | | 755 4 7 | | |
| North Central Wagon and Finance Co. Ltd.—Cash on Deposit .. .. .. .. .. | | 273 0 4 | | |
| Leek & Moorlands Building Society .. .. | | 43 11 6 | | |
| Cash at Bank—Current Account .. .. .. | | 2 16 1 | | 993 |
| | | | 3,190 16 8 | 3,109 |
| JUBILEE FUND ASSETS | | | | |
| INVESTMENT, at par | | | | |
| £820 3% Savings Bonds 1965–75 | | 820 0 0 | | 820 |
| (Market Value 31st August, 1959 £627) | | | | |
| Leek & Moorlands Building Society | 187 16 6 | | | |
| Cash at Bank—Current Account | 50 15 2 | | | |
| | | 238 11 8 | | 212 |
| | | | 1,058 11 8 | 1,032 |
| HERBERTSON MEMORIAL FUND ASSETS | | | | |
| INVESTMENT, at par | | | | |
| £250 3% Savings Bonds 1965–75 .. .. | | 250 0 0 | | 250 |
| (Market value 31st August, 1959 £191) | | | | |
| Leek & Moorlands Building Society .. .. .. .. .. | 37 9 0 | | | |
| Cash in Bank—Current Account | 15 6 3 | | | |
| | | 52 15 3 | | 45 |
| | | | 302 15 3 | 295 |
| | | | £13,450 11 6 | £11,037 |

We have audited the above Balance Sheet, dated 31st August, 1959 and certify that in our opinion it is properly drawn up so as to exhibit a true and correct view of the position of the Association at that date, according to the best of our information, and the explanations given to us, and as shown by the books of the Association.

(*Signed*) HOLMES, WIDLAKE & GIBSON,
*Chartered Accountants.*

SHEFFIELD.
*November*, 1959.

L. DUDLEY STAMP,
*Honorary Treasurer.*

# THE GEOGRAPHICAL ASSOCIATION

## INCOME AND EXPENDITURE ACCOUNT for the year ended 31st August, 1959

*Dr.*

| | £ s. d. | £ s. d. | £ s. d. | 1958 £ |
|---|---|---|---|---|
| To *Geography*: | | | | |
| Printing and Publishing .. .. .. .. | | 2,382 1 8 | | 2,430 |
| Blocks .. .. .. .. .. .. | 72 1 0 | | | |
| *Less* Authors' Contributions | 26 13 0 | | | |
| | | 45 8 0 | | 56 |
| Postages, Carriage and Wrapping .. .. | | 558 10 4 | | 340 |
| | | | 2,986 0 0 | 2,826 |
| ,, Special Publications: | | | | |
| Stock at 1st September, 1958 .. .. .. | | 263 10 10 | | 360 |
| Printing .. .. .. .. .. .. .. .. | | 287 18 9 | | 44 |
| | | 551 9 7 | | 404 |
| *Less* Stock on hand 31st August, 1959 .. | | 364 9 2 | | 264 |
| | | | 187 0 5 | 140 |
| ,, Printing and Stationery .. .. .. .. .. .. .. .. .. .. | | | 216 19 10 | 164 |
| ,, Addressograph .. .. .. .. .. .. .. .. .. .. .. | | | 19 7 0 | 14 |
| ,, Insurance .. .. .. .. .. .. .. .. .. .. .. .. | | | 23 8 7 | 21 |
| ,, Salaries and National Insurance .. .. .. .. .. .. .. | | | 1,942 15 4 | 1,765 |
| ,, Staff Superannuation Pension Scheme .. .. .. .. .. | | | 90 0 0 | 86 |
| ,, Postages—General .. .. .. .. .. .. .. .. .. .. | | | 345 5 0 | 286 |
| ,, Sundry Office Expenses .. .. .. .. .. .. .. .. .. | | | 27 11 11 | 25 |
| ,, Library Expenses .. .. .. .. .. .. .. .. .. .. | | | 55 3 1 | 40 |
| ,, Telephone .. .. .. .. .. .. .. .. .. .. .. .. | | | 39 8 9 | 39 |
| ,, Bank Charges .. .. .. .. .. .. .. .. .. .. .. | | | 21 5 8 | 22 |
| ,, Publicity .. .. .. .. .. .. .. .. .. .. .. .. | | | 42 9 11 | 64 |
| ,, Officers' Standing Committee Expenses .. .. .. .. .. | | | 122 12 11 | 183 |
| ,, Donations and Subscriptions .. .. .. .. .. .. .. .. | | | — — — | 5 |
| ,, Accountancy Charges .. .. .. .. .. .. .. .. .. .. | | | 63 0 0 | 63 |
| ,, Subventions to Branches .. .. .. .. .. .. .. .. .. | | | 48 12 0 | 47 |
| ,, Depreciation of Office and Library Furniture and Equipment | | | 89 19 9 | 69 |
| ,, Office and Library Alterations .. .. .. .. .. .. .. | | | 167 2 7 | — |
| ,, Training College Section Memorandum .. .. .. .. .. | | | 17 5 7 | — |
| ,, Repairs and Renewals .. .. .. .. .. .. .. .. .. | | | — — — | 14 |
| ,, Transferred to Removal Reserve .. .. .. .. .. .. .. | | | 800 0 0 | — |
| ,, Balance—Excess of Income over Expenditure for the year carried to Accumulated Fund .. .. .. .. .. .. .. | | | 126 5 1 | 452 |
| | | | £7,431 13 5 | £6,325 |

*Cr.*

| | £ s. d. | £ s. d. | 1958 £ |
|---|---|---|---|
| By Sales of Publications .. .. .. .. .. .. .. .. .. | | 565 12 5 | 753 |
| ,, Sales of Special Publications .. .. .. .. .. .. .. | | 668 15 10 | 228 |
| ,, Advertisements .. .. .. .. .. .. .. .. .. .. .. | | 838 5 0 | 735 |
| ,, Returned Library Postages .. .. .. .. .. .. .. .. | | 49 6 7 | 54 |
| ,, Sale of Library Books .. .. .. .. .. .. .. .. .. | | 94 13 0 | — |
| | | | 1,770 |
| ,, Subscriptions: | | | |
| Current .. .. .. .. .. .. .. .. .. .. | 4,324 9 5 | | 3,949 |
| Refund of Income Tax on Covenanted Subscriptions .. .. .. .. .. .. .. | 141 10 2 | | — |
| Arrears .. .. .. .. .. .. .. .. .. .. | 15 14 1 | | 13 |
| | | 4,481 13 8 | 3,962 |
| ,, Study Courses and Conferences: | | | |
| Amount allocated for Administration Expenses .. .. | | 425 0 0 | 300 |
| ,, Interest on Investments and Building Society Deposits: | | | |
| (Investments and Deposits held on Life Membership and Accumulated Funds) | | | |
| Government Stocks (Gross) .. .. .. .. | 64 11 1 | | 70 |
| Preference Shares (Gross) .. .. .. .. | 112 9 11 | | 113 |
| Lloyds Bank Deposit .. .. .. .. .. | 23 4 3 | | 72 |
| Leek & Moorlands Building Society Deposit .. .. .. .. .. .. .. .. .. | 9 9 5 | | 8 |
| Sale Corporation Mortgage Loan .. .. | 19 0 | | — |
| North Central Wagon and Finance Co. Ltd. .. .. .. .. .. .. .. .. .. | 43 6 3 | | — |
| | | 253 19 11 | 263 |
| ,, Gifts .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. | | 54 7 0 | 30 |
| | | £7,431 13 5 | £6,325 |

# THE GEOGRAPHICAL ASSOCIATION

*Dr.* **STUDY COURSES AND CONFERENCES—INCOME AND EXPENDITURE ACCOUNT for the year ended 31st August, 1959** *Cr.*

| | £ | s. | d. | £ | s. | d. | 1958 £ |
|---|---|---|---|---|---|---|---|
| To Expenses of Conferences and Courses .. .. .. .. .. | | | | 4,813 | 14 | 8 | 3,354 |
| ,, Transfer to General Income and Expenditure Account for Administration .. .. .. | 425 | 0 | 0 | | | | |
| ,, Printing and Postage, etc. .. .. .. .. | 48 | 10 | 0 | | | | |
| | | | | 473 | 10 | 0 | 339 |
| ,, Balance, being Excess of Income over Expenditure transferred to General Reserve .. .. .. .. .. .. .. .. | | | | 247 | 17 | 8 | 414 |
| | | | | £5,535 | 2 | 4 | £4,107 |

| | £ | s. | d. | 1958 £ |
|---|---|---|---|---|
| By Income from Fees and Advertisements, etc. .. .. .. | 5,535 | 2 | 4 | 4,107 |
| | £5,535 | 2 | 4 | £4,107 |

### PRESIDENT OF THE ASSOCIATION 1960

We have welcomed in office our new President, Professor A. Austin Miller, who took up his duties in January 1960.

### THE LATE MR. G. J. CONS, PRESIDENT-ELECT 1961

Mr. G. J. Cons was elected as President-Elect for 1961 at the meeting of Council held on 30th December 1959. It was with the deepest sorrow, however, that we learned that the Association has been deprived of the honour of having him as its President by his death on 15th January. An obituary notice is published elsewhere in this issue.

### ELECTION OF MEMBERS OF COUNCIL

The following members were elected at the Annual General Meeting on 31st December, 1959 to serve on Council for the years 1960–62, replacing retiring members: Mr. T. H. Elkins (University of London King's College), Mr. R. Kneeshaw (Bristol Branch), Dr. H. Thorpe (Birmingham Branch) and Mr. H. J. Savory (West Middlesex Branch). Mr. G. S. Hall (already serving on Council) and Dr. Thorpe were elected to serve on the Executive Committee.

### ANNUAL CONFERENCE 30TH DECEMBER 1959 TO 2ND JANUARY 1960

This was a conference marked for those who attended it by several outstanding features—the vigorous, if at times irrelevant, discussions appertaining to various aspects of the teaching of our subject which enlivened the opening day; the brilliant sequence of lectures on topics associated with geomorphology, in a symposium by Dr. E. H. Brown, Mr. B. W. Sparks, Professor R. W. Peel, Dr. J. C. Pugh and Mr. R. Kay Gresswell; the thought-provoking presidential address by Professor J. A. Steers on Physiography, matched later, in quite different vein, by a philosophical lecture on the Idea of a Region, delivered as a Herbertson Memorial lecture by Professor E. W. Gilbert. These were followed on Friday by another highlight in the joint meeting of the three main geographical societies when, at the House of the Royal Geographical Society, we enjoyed not only generous hospitality but were privileged to hear a lecture by Professor E. G. Bowen delivered in his inimitable style. We are also indebted to Miss Alice Coleman and Mr. K. R. Maggs for a lecture-demonstration of their proposals for a new Land Use Survey, and to Mr. D. Ferguson for opening a lecture-demonstration of films in the teaching of geography.

A day of excellent field excursions, the twenty-ninth annual dinner, a closely integrated series of business meetings and extensive publishers' and other exhibitions completed a programme outstanding both for its content and for the record attendance by some 700 members who taxed the seating capacities of the lecture theatres up to and beyond their limits. The evergrowing popularity of the annual meeting now presents a problem of future accommodation extremely difficult to resolve, even in London, to which the officers are already giving serious thought.

Year by year, as our conference grows in popularity and support by our members, we increase the more the great debt we owe to our indefatigable conference organizers Mr. R. C. Honeybone and his able assistant Dr. J. H. Bird. They have maintained and further expanded a tradition of conferences of very high standing and we congratulate and thank them warmly not only for a highly successful design of conference themes, but also for their brilliant organization, year after year. Only those who have undertaken similar ventures can even begin to appreciate how much thought, hard work and abundant patience underlies such splendid achievement.

### SPRING CONFERENCE 1960

The Spring Conference is being held at Durham under the direction of Professor W. B. Fisher, from 19th to 23rd April.

### SUMMER SCHOOL 1960

A residential course, from 17th to 31st August at Slapton Ley, South Devon, will cover practical field techniques in physical and cultural geography. Inquiries about this School should be sent to the Assistant Secretary at headquarters office.

### SPECIAL PUBLICATIONS

#### *British Landscapes through Maps*

Two books in this series, which is edited by Professor K. C. Edwards, are now available: *The English Lake District* by F. J. Monkhouse, and *The Yorkshire Dales* by C. A. M. King. Both are illustrated with photographs and maps. The special price for members of the Geographical Association is 3s. 6d. post free, for orders sent direct, with payment enclosed, to the Association and not through booksellers.

A forthcoming title in the series is *Guernsey* by Professor H. J. Fleure.

#### *Exercises on Ordnance Survey Maps*

The Secondary Schools Section of the Association is preparing sets of exercises for use with books in the series *British Landscapes through Maps* along with relevant O.S. maps. The first booklet in this series, which is edited for the Section by Mr. A. J. Nicholls, provides questions and exercises on the Lake District Tourist Map. Grouped under such headings as "Use of scales; distances, directions and areas" and "Spot heights, contours, slopes and sections", the exercises are intended to indicate the type of questions which may be used in school work with O.S. maps by pupils in many kinds of schools and with a wide range of abilities and ages. The booklet is in the same format as *The English Lake District* and may be purchased by members for 1s. 6d. post free, or in sets of 12 or more, for 1s. 3d. each, post free; payment should be sent with the order.

It is planned to publish similar exercises based on other map sheets described in the *British Landscapes* series.

#### *Geography in Secondary Schools*

To satisfy continued demands for this booklet, work has started on a reprint edition, revised to bring reference material up to date. Supplies are expected from the printer in May and the price will remain at 2s. post free.

### ACKNOWLEDGMENT

Grateful acknowledgment is made of a generous grant made by the Durham Colleges in the University of Durham towards the cost of illustrating "Statistical Mapping" by J. I. Clarke in *Geography*, vol. xliv, April 1959.

### LAND USE SURVEY

Members of the Association may be interested to participate privately or as part of a school activity in a proposed new land use survey, full details of which can be obtained from the organizers, Miss A. Coleman, M.A., King's College, Strand, London W.C.2 and Mr. K. R. Maggs, B.Sc., 183 Ramsgate Road, Broadstairs, Kent. In view of inquiries which have already been addressed to headquarters office about this project, it is necessary to state that the Association is unable to give financial assistance for the purchase of maps or for any other expenses that may be incurred by members participating in the survey. All inquiries should be addressed direct to the organizers.

### INSTITUTE OF AUSTRALIAN GEOGRAPHERS

Since 1958 Australian geographers have been planning the initiation of a professional organization for geographers in that continent. Their efforts have come to

fruition in the founding of the Institute of Australian Geographers which held its first general meeting at Melbourne in January 1960. The first President is Professor Griffith Taylor. Congratulations to the founder members are joined with the good wishes of the Geographical Association for the future of this new Institute, which is in itself one expression of the development of geography as a subject and of its status in Australia.

### INTERNATIONAL CONGRESS OF PHOTOGRAMMETRY

The ninth International Congress of Photogrammetry will be held at the University of London from 6th to 16th September, 1960 under the auspices of the International Society for Photogrammetry. The British hosts are the Royal Institution of Chartered Surveyors and the Photogrammetric Society. Information about the Congress programme may be obtained from the Congress Director, 18 Cavendish Square, London W.1.

### WHEAT INTO FLOUR

In the note on a teaching unit "How Self-Raising Flour is Made" produced by McDougalls Ltd., published in *Geography*, vol. xliv, November 1959, p. 277, it was erroneously stated that the unit could be obtained free. The price is in fact 7s. 6d. (including postage); the address is Miss Janet Johnson, Dept. PR, McDougalls Ltd., Wheatsheaf Mills, Millwall Dock, London E.14.

### METEOROLOGICAL INSTRUMENTS

Geography teachers who are considering the setting up of a meteorological station at their schools will find useful an illustrated brochure *A Selection of Meteorological Instruments for Schools* (booklet no. 909), published by C. F. Casella and Co. Ltd., Regent House, Fitzroy Square, London W.1, from which address copies can be obtained on request.

### FIELD STUDIES

The Field Studies Council (formerly the Council for the Promotion of Field Studies) publishes an Annual Report of the progress of affairs at its several field centres. In past years the Report has included illustrated articles on research topics associated with the centres, but such a medium of publication could do little justice to the value of the scientific work carried out by the field staff and assistants of the Council. To overcome these restrictions on the publication of scientific papers, the Field Studies Council has initiated an additional publication, aptly titled *Field Studies*, of which volume 1, no 1 for May 1959 was issued last year. As one would expect the papers in this new periodical will mostly belong to several fields of study: archaeology, botany, geography, geology and zoology, and at first they are likely to be related to the immediate neighbourhoods of the Council's six centres. It is intended also, however, to include review articles from time to time which will make available to students information difficult of access because it is so scattered through scientific literature.

Of eight articles in the first issue, four are of interest to geographers: "Land use and farm practice in the parish of Dale" (B. J. Dresser), "The climate of Dale Peninsula, Pembs." (J. Oliver), "The geomorphology of Tillingbourne" (V. J. Mercer) and "The geography of the Alberbury Breccia, Shrops." (I. D. Mercer). A fifth would be useful reading for visitors to the Malham Tarn area: "Stratigraphy and pollen analysis of Malham Tarn and Malham Moss" (M. E. and C. D. Pigott). The approach of the staff of the centres to field work is illustrated in the introduction to the paper on the Alberbury Breccia, which study is based on work undertaken as a demonstration of method, an example of a type of long-term project which could be carried out by student geographers at school or at a field centre. For any one who

wishes to learn more about the prosecution both of field work and of the laboratory and library work needed to complete a piece of local study, an examination of the papers published here should yield both guidance and encouragement.

*Field Studies* is to appear once yearly, five annual parts making one volume; the price of no. 1 is 5s. 6d. including postage and it may be obtained from The Publicity Secretary, Field Studies Council, Ravensmead, Keston, Kent. Geographical papers in *Field Studies* will in future be listed in *Geography* in the feature "Geographical Articles".

### U.S.S.R. GEOGRAPHICAL PUBLICATIONS

An exchange of publications has been arranged between the Geographical Association and the Academy of Sciences of the U.S.S.R., by means of which the Association's library will receive the Bulletin of the Academy of Sciences of the U.S.S.R., Geography series (6 in a year) and the Bulletin of the U.S.S.R. Geographical Society (6 in a year). No. 1 of the 1960 volume of the Bulletin of the Academy of Sciences has already been received and it contains articles under several headings, ranging from research material to reports of activities in the geographical world at large. The journal is entirely in Russian, without foreign language summaries. English titles of articles will be listed in *Geography* in "Geographical Articles".

English-speaking geographers will be interested to learn also of a new publication by the American Geographical Society: *Soviet Geography: Review and Translation* (editor T. Shabad) of which vol. 1, no. 1–2 is for January–February 1960. Designed "to acquaint American geographers with the work of their Soviet colleagues", this periodical will contain mostly reports of current Soviet research in geography, translated from the Bulletin of the Academy of Sciences of the U.S.S.R., Geography Series, from the Bulletin of the Geographical Society of the U.S.S.R., and from a serial publication of the Moscow Branch of the Geographical Society of the U.S.S.R. There will also be news notes on Soviet political and economic developments of interest to geographers and surveys of Soviet geographic literature.

The first issue contains: "The present status and aims of Soviet geography" (I. P. Gerasimov); "The work of the Institute of Geography of the Academy of Sciences of the U.S.S.R. in 1957" (D. V. Kravchenko); "Results and aims of physical regional geography in the U.S.S.R." (E. M. Murzayev); "Development and next tasks of geomorphology" (Y. D. Zekkel); "Results and tasks of studies in regional economic geography at the Institute of Geography, Academy of Sciences" (S. N. Ryazantsev); "The zonal character of the cold Pole" (Y. P. Parmuzin); "An experiment in the economic geographic study of the cities of the U.S.S.R." (M. I. Pomus); "The major economic regions of Brazil" (V. V. Pokshishevskiy); "Map of the forests of the U.S.S.R." (review); News notes (reports on the fulfilment of the 1959 economic plan and on the plan for 1960) and articles listed from current literature.

*Soviet Geography* is to be published monthly (except July and August) with an average of 80 pages. The annual subscription is $6; a single copy costs $1, payable in dollars to *Soviet Geography*, American Geographical Society, Broadway at 156th Street, New York 32, New York, U.S.A.

### *The Geographical Magazine*
#### A SPECIAL NUMBER

The April 1960 issue of *The Geographical Magazine* is of special interest to geographers and teachers, in that it is a special number devoted to atlases and mapmaking. Articles include "Early Atlases", "Atlases Today", "The Ordnance Survey", "Modern Survey Methods", and "A Guide to Guides and Maps". There are many line illustrations and photographs, some in colour, in this issue which is well worth acquiring for addition to a library collection. *The Geographical Magazine* can be ordered through booksellers, price 2s. 6d.

# Reviews of Books

With very rare exceptions books reviewed in this journal may be borrowed from the Library by full members and student library members of the Association.

**The Place-Names of Derbyshire. Pts. 1–3.** The English Place-Name Society. Vols. XXVII-XXIX. K. Cameron. 14×22·5 cm. lxxxiv+829 pp. Cambridge: Cambridge University Press. 1959. 35s. each.

The material relating to Derbyshire contained in the three latest volumes published by the Place-Name Society follows the usual long-established arrangement. The largest section is naturally that dealing with the individual names themselves and this occupies more than two-thirds of the first part, all of the second and about half of the third. When so much information is included in this section it may perhaps seem to be carping to suggest it is not always as complete as it might be. But for the parish (Dore) in which the reviewer himself lives, an explanation is given of the meaning of only just over a quarter of the minor names listed: no mention is made of the fact that an earlier form of Houndkirk (Hill and Moor) was Ankirk or of the strong local tradition that King's Croft derives its name from the meeting of King Ecgbert of Wessex and King Eanred of Northumbria at Dore in A.D. 829.

Apart from its undoubted value as a work of reference, perhaps the chief interest of the present volumes to the geographer is to be found in Dr. Cameron's Introduction which clearly brings out the importance of place-name study, particularly to the historical geographer. The relevance of such work to the Dark Age settlement of the area is shown again and again, though it is equally clear that without the complementary field work the whole story can never be told. Thus the discussion relating to the place-name evidence for the alignment of the lost portion of Ryknield Street north of Tupton can obviously never be conclusive without detailed field investigation. Again, mention is made of the numerous names that were associated with the chase of Duffield Frith and the separately paled parks that lay within it—have we here the clues to landscape features that are otherwise impossible to explain? Occasionally, however, Dr. Cameron makes statements that, to the geographer, must seem rather naïve: "The Carboniferous Limestone uplands offered few attractions to the settler" (but they may still have offered more than the surrounding areas); "few [other names in *–thorpe*] are the names of important places" (the importance of a place has usually varied greatly over the years); "The earliest place-name in the county indicative of woodland is a Celtic name, surviving as Morley Lime. This is evidence of an extensive wooded area in the south-east of Derbyshire" (surely one name by itself cannot give evidence of an *extensive* wooded area).

The maps, unfortunately, are disappointing. They show the distribution of selected place-name elements but no attempt has been made to relate these distributions to the significant factors of environment that existed at the time when the settlers used these elements to name their farms and villages. And yet it is clear from the written account that Dr. Cameron is well aware of the importance of these environmental factors. Certainly, the work as a whole worthily maintains the high traditions of the publications of the English Place-Name Society. I. S. M.

**The Great Tide: The story of the 1953 flood disaster in Essex.** H. Grieve. 19×25·5 cm. 883 pp. Chelmsford: County Council of Essex. 1959. 30s.

This could well have been a dull record of the administrative view of a disaster; in fact it is a remarkably enthralling and well-told story. It would be difficult to overpraise the enterprise of Essex County Council, not simply in producing this book, but in appointing a historian from the Essex Record Office to write it. Geographers will welcome the careful analysis of the history of coastal floods, of the

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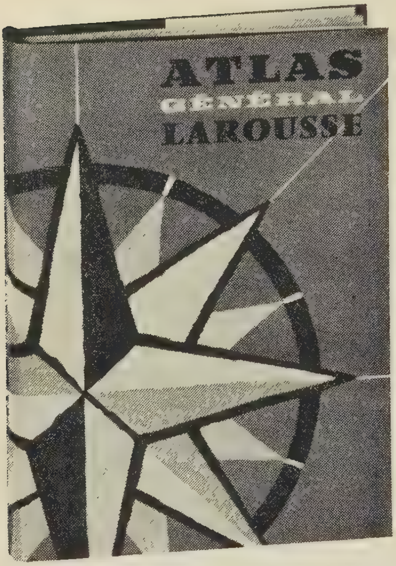


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origin of the storm surges that have usually caused them, and the reference to the subsidence of the Essex coastal area. The damage caused in 1953 was far more serious than in previous floods, a direct result of the changing land use of these coastal marshes. Instead of the flooding of pastures, major factories were out of action for weeks, retired people were drowned in their bungalows, and caravans (fortunately largely deserted in February) were piled into heaps.

The story so carefully and forcefully told by Miss Grieve shows how often people underestimated the seriousness of the situation until it was almost too late to do anything at all. But they did do what they could, and it is the story of local disaster, of individual enterprise and sometimes of long suffering that takes up the bulk of the book. It is a pity that despite the other good maps in the book the weather maps were not redrawn and made more legible, but this is a minor criticism of an excellent and remarkably cheap book. K. M. C.

**An Historical Atlas of Wales from early to modern times.** W. Rees. 19×25·5 cm. vi+71 pp.+70 plates. London: Faber & Faber. 1959. 22s. 6d.

What does this *Atlas* offer the student of Welsh geography? On the face of it a great deal, since the author begins with "the physical configuration" of Wales and sets out to indicate "the main historical and geographical factors". This is splendidly achieved for certain topics (notably Roman Wales, the Norman incursion, Cistercian estates, and the political geography of the Act of Union, 1536), but in general the *Atlas* tantalizes by suggesting what could be done in a work of this kind. The geographical introduction is sketchy and selective: Wales is not placed among the "Atlantic" regions, its environment is discussed simply in terms of solid geology and altitude. Then the maps do not always do credit to the commentaries written about them; e.g., the important map of medieval manors is badly drawn, without a key, and is hardly a faithful reduction of Professor Rees's pioneer *Map of South Wales and the Border in the Fourteenth Century*. The industrial maps are not quantitative and rather approximate, there is nothing on coastal trade or the growth of sea-ports. One innovation since the *Atlas* first appeared in 1951 is the choropleth map of population in 1851, but the orange tints are scarcely distinguishable. The *Atlas* continues to be an essential and authoritative source for Welsh history; as such it is useful for historians rather than geographers, especially on the medieval centuries; ten maps portray the Glyndwr Rebellion of 1400–13, while economic changes from 1600 to 1850 are shown in fifteen. F. V. E.

**The Rhondda Valleys: A study in industrial development, 1800 to the present day.** E. D. Lewis. 16×25·5 cm. ix+312 pp. London: Phoenix House. 1959. 25s.

The stimulus to the publication of this book was the elevation in 1955 of the Rhondda Urban District to the status of a Municipal Borough. A volume published in such circumstances is open to two dangers—it may become first an unselective and unacademic guide and second, an uncritical tribute to the area and its people. Whilst, perhaps excusably, not escaping the second danger, it is pleasant to record that this book avoids the first. This is not just another general topographical work, for the bulk of the book is an authoritative and well-documented economic history of the Rhondda Valleys up to 1914; the last chapter alone is concerned with subsequent developments to 1955. The least successful parts of the book are those dealing with "The Life of the People" for here the academic discipline of the earlier parts is not uniformly sustained and the author occasionally lapses into a guide book manner, for example, in listing Rhondda boxers and rugby internationals. Such lapses, however, should not be held against a book which provides a thorough and readable account of the industrial development of these valleys. Geography students

in training colleges and university departments will find in this volume much valuable background material for their study of the economic geography and regional character of one of the most distinctive industrial *pays* in South Wales.

H. C.

**Park. A geographical study of a Lewis Crofting District.** J. B. Caird. 20·5 × 25·5 cm. iv + 40 pp. Published jointly by the Department of Geography and the Geographical Field Group. Obtainable from Hon. Secretary, Geogr. Field Group, Nottingham University. 1959. 6s. 6d.

At the invitation of the local Pairc Association and with the help of the Geographical Field Group, the Crofting Survey of the Hebrides by the Geography Department of Glasgow University was extended in 1958 to the district of Park in southeast Lewis. Members of the group, led by Dr. Caird of Glasgow, made a detailed survey of land use and population, township by township and croft by croft, and this Study, including 20 tables and 10 maps and diagrams, reports the main results of their work.

A series of penetrating analyses sets forth the Environment of Park, isolated, rugged, and agriculturally poor; the Making of the Crofting Landscape since the late 17th century; the Pattern of Crofting Organization and Agriculture; the essential Ancillary Occupations both within Park, where they are very limited, and beyond it; and the Population of some 900 which is ageing and declining, as a result of persistent migration to Stornoway and the Lowlands. There follow detailed accounts of similar lines on each of the 13 townships dispersed along 20 miles of coasts. In these the emphasis is on the agricultural basis of crofting, the treatment of other matters varying somewhat in scope and authority. A concluding section emphasizes that a smaller number of more productive agricultural units is needed, that distinctive crofting and non-crofting groups should be formed, with a revival of fishing and some tourism, and that further research is needed on the minimum viable level and structure of population.

This report and the permanent collection of statistics and 25-inch and other plans held in Glasgow University provide a most valuable detailed record of a particular crofting landscape and society in transition. They also make an important contribution, especially on the agricultural side, to the continuing task of assessing and exploiting opportunities for local development.

F. D. N. S.

**A Regional Geography of Western Europe.** Geographies for Advanced Study. F. J. Monkhouse. 14·5 × 22·5 cm. xx + 726 pp. London: Longmans, Green & Co. Ltd. 1959. 50s.

This new member of Longmans' well-known series is a detailed description, region by region, and *pays* by *pays*, of France, the Low Countries and Luxembourg. As Professor Monkhouse is quick to point out, this area represents an editorial apportionment, not a new conception of the limits of western Europe. "Nor", he continues, "does this book offer a regional study of these four sovereign states as individuals, but is based on major structural and physical units which inevitably disregard man-made frontiers." These prescribed limits are closely adhered to. There is no systematic introduction other than a brief outline of the basis of regional division, and no conclusion to put the regions in perspective as interdependent parts of a country or of western Europe as a whole. Those who look for systematic treatment of elements or of topics such as the Common Market must do so elsewhere. The book consists in essence of regional studies of the fourteen major regions, grouped for convenience into the Lowlands, the Hercynian Uplands and the Fold Mountains, though any one study could have been published separately in its own right. Each region is

treated on similar lines: general features, division into *pays*, and description of the *pays* themselves. There are marked inequalities in emphasis and in length of treatment between regions which reflect the author's special interests rather than intrinsic differences between the regions themselves. It seems even more strange to find the important industrial region of Le Nord tucked away in half a dozen pages under Interior Flanders, and divorced by 350 pages from the comparable account of the Sambre-Meuse industrial region. Co-ordination in such cases is not made easier by the omission of a general index in favour of a place-name index alone. Illustrations are numerous but remarkably uniform. The 64 half-tones are all oblique air photographs which, although a highly effective medium of illustration, would perhaps have been enhanced by the inclusion of an occasional ground view. Maps and diagrams are numerous and admirably clear though many are little more than location maps showing rivers, spot heights and position of settlements, together with one or two other features such as *pays* boundaries, railways or escarpments. Few of them show the distribution patterns or correlations of a kind to be looked for in advanced geographical studies.

Leaving aside points of criticism which are all too easy to find in a regional work on this scale, let alone one describing an area which has been written about so often and so well before, one must congratulate Professor Monkhouse on having tackled single-handed, and completed so successfully, a task which few other geographers would have cared to attempt. He has assembled an immense amount of information from published papers and monographs and from statistical sources as well as his own observation and research. This he has presented methodically and concisely within a truly geographical framework of physical geographical regions. The resulting work is comprehensive and almost encyclopedic in scope. It is readable but too closely packed with information relating to small areas to meet all the needs of a general text-book. Used in conjunction with systematic works covering the same area, a good atlas and selected topographic maps, it will be most useful to teachers and students as a convenient reference book and as an introduction to original sources for advanced study.

A. J. H.

**The Pattern of Asia.** N. S. Ginsburg (editor). 16×23·5 cm. xiv + 929 pp. London: Constable & Co. Ltd. 1959. 70s.

The appearance of a volume of this scale attempting to comprehend the whole of Asia, calls in question the soundness of an approach based upon the anachronistic division of the "World-island" into three continents. The Asiatic part of U.S.S.R. can hardly be studied seriously outside the context of the Soviet Union as a whole, nor can Syria's political and economic geography be dissociated from that of its partner Egypt. Inevitably that part of the introduction which may be regarded as truly general is limited to 20 pages. It is followed by a stimulating chapter on "Patterns and Problems of Asian Asia" (i.e. Asia less U.S.S.R.) and thence onwards (from p. 46) the work treats Asia as divided into five major realms: east, southeast, south, southwest and soviet.

The strength of the book lies in its treatment of the modern political, social and economic scene, realm by realm, state by state, refreshingly portrayed (for the British reader) by authors devoid of political bias towards imperialism of any colour. (Nonetheless, greater regard for the religious susceptibilities of Hindu and Muslim might have prompted the omission of Fig. 124 showing a former Hindu temple occupied by a Muslim refugee family.)

The physical basis of life is less adequately dealt with and the reader is referred to standard works for climatic maps. Variability of rainfall and actual maximum and minimum temperatures are important aspects of climate rarely mentioned.

The maps are generally well conceived but unevenly executed. Thus the thumbnail sketch maps of land occupance types in India and Pakistan need to be larger and clearer to achieve their object, while a full-page diagram of ricefield patterns in Tonkin and Cambodia ("French Indochina"!) is space wasted. China's new provinces badly need a map, the more so as the Wade-Giles system for Romanizing Chinese placenames is likely to cause the British reader some difficulty: Szechwan (as on Map 10) is rendered Ssu'ch'uan in the text. There is an excellent collection of more than 160 photographs, each carefully annotated to good effect.

The book, despite certain failings as a complete geography of Asia, has sufficient originality in material and presentation to make it a worthy addition to the libraries of sixth forms, colleges and universities, where it can provide a very readable complement to the volumes already available.

B. L. C.

**National Atlas of India (Preliminary Edition).** Edited by S. P. Chatterjee. 44 × 66 cm. xxi + 26 plates. Calcutta and Dehradun: Government of India, Ministry of Education and Scientific Research. 1957. Rs. 125.00.

This is a fine atlas, in conception, in content and in execution. As a geographer, Professor Chatterjee has realized the need to produce maps that show much more than simple (and single) distributions. Thus the main map on Plate 12 (Irrigation) not only distinguishes the areas irrigated by the different types of irrigation systems (canals, wells and tanks), but also shows the percentage of irrigated land to the total cropped land, while two inset maps record the growth of irrigation between 1910 and 1954 and the percentage of irrigated land to the total land area. A similar variety of features is included on most of the plates which themselves cover a wide range of topics; for example, from temperature and winds to geolithology and from electric power to archaeology and tourism. But, although three plates deal with various aspects of the Indian population, there is no map showing the distribution of either language or religion, a significant omission in view of the history of the country in the ten years preceding the publication of the atlas. Presumably it was political considerations which also decreed that the atlas should be published in Hindi, a language unintelligible to so many Indian nationals that an English version of every map legend and of the "Notes on the Compilation and Contents of the Atlas" had to be provided. The atlas can therefore be used by English-speaking people but it is a rather tedious process requiring much patience and effort. Thus when using the legends it is necessary to remember the difference between colour tints and colour screens and to realize that when a distribution is given "statewise" it means simply that the state has been taken as the unit for purposes of calculation and mapping. Nevertheless, a careful study of this atlas is undoubtedly very rewarding.

I. S. M.

**Indian Village.** S. C. Dube. International Library of Sociology and Social Reconstruction. 14·5 × 22 cm. xii + 248 pp. London: Routledge and Kegan Paul. 1956. 25s.

This is a very interesting book though in content it is not particularly geographical. It contains a large amount of sociological material, based on field investigations, relating to many aspects of life in one particular village (Shamirpet) lying some twenty-five miles from Hyderabad. As Dr. Dube himself says, "No village in India can be singled out as being typical of the country as a whole, but Shamirpet possesses most of the characteristics which are common to the rural communities in middle and peninsular India". For those engaged in teaching school children about the geography of the Indian region it should provide useful background material; it would not be of much direct use to the pupils themselves.

I. S. M.

**Man in Malaya.** B. W. Hodder. 14×22 cm. 144 pp. London: University of London Press. 1959. 12s. 6d.

This is a short but valuable supplement to the comprehensive regional accounts of Malaya available in other works. Opening chapters on the land and the growth of settlement up to 1900 are followed by an interesting account of population structure and distribution. The replacement of migrational surplus by natural increase as the principal factor determining the growth of population is discussed. The population of Malaya is becoming younger in its age composition. If present trends continue, by 1972 about half the population of Singapore will be under 15 years of age. The consequences of these and other demographic facts are dealt with in a chapter on economic life which includes a statement on industrialization and the prospects of a policy of family limitation. A chapter on the detail of rural settlement has interesting maps, and an account of the new towns and villages created by the resettlement of Chinese "squatters". A short section headed "Climate and Man in Malaya" deals with human physiological responses to the local climate. Later chapters on water supply, soil erosion and sedimentation deal with the problems of water shortage for various purposes in this wet environment, and the need for control of timber felling and alluvial mineral workings. The last chapter "Health, disease and diet" is a useful summary.

In addition to well-known sources the bibliography contains many titles which would not otherwise come to the notice of non-specialist readers. The 16 plates deserve close attention. The book is thoroughly to be recommended for sixth form and university study.

R. R. R.

**Under Chartered Company rule (North Borneo 1881–1946).** K. G. Tregonning. 14·5×22·5 cm. 250 pp. Singapore: University of Malaya Press. London: Oxford University Press. 1958. 30s.

In 1946 the records of the British North Borneo Company were deposited at the Colonial Office Library. When Mr. Tregonning gained access to them in 1950 they "were bundled haphazardly into six large tin trunks, or were piled on the floor at one end of the Library, waiting to be catalogued . . . " By working through those records and all the Colonial Office correspondence relating to the Company from 1881 to 1941, he has produced a comprehensive account covering the early American and Spanish claims in the area, the growth of the British Chartered Company and its relations with the Colonial Office, and the administrative, economic and social development of North Borneo. There is also a short chapter on the Japanese occupation.

A good story with interesting detail on the chief personalities, it is worth reading for its own sake. For the geographer it is also a new and authoritative source on a neglected portion of southeast Asia.

R. R. R.

**The Geography of Ghana.** W. J. Varley and H. P. White. 13×19 cm. 313 pp. London: Longmans Green. 1958. 11s.

**A Geography of Ghana.** E. A. Boateng. 14×22 cm. xvi+205 pp. Cambridge: University Press. 1959. 21s.

The declared intent of these text-books, both products of the University College of Ghana, is to give definitive texts for upper schools. The Cambridge University Press publication is by far the more handsome, but after close examination of the contents of both books one must give the accolade to the Longmans book for its geographical value. It is no exaggeration to say that the section on the social

geography of Ghana as written by H. P. White is the most thorough presentation of tropical economies to be found in English at this level, while Varley's unusual approach to the physical basis is both stimulating and unconventional. For English students and especially for those in the throes of university regional work, Varley and White will serve as the finer introduction.

Mr. Boateng's more conventional text would require far more extended treatment, less simplification and greater regard for students' needs in the way of critical bibliography of sources and evaluation of map sheets before the book could be said to fulfil its intent as an introductory university textbook for Ghanaians. For the general public, however, who require not more than general topography, simplicity of style and industrious collation combine to form a generous introductory description.

Some practical comparisons can be made. On the grounds of their use as sources for sample studies for lower school use and on the basis of cost, Varley and White provide the richer and more interesting fare, and their less numerous, but more geographical photographs contrast with the more formal, official pictures amply provided in the larger book.

R. W. C.

**Accra Survey.** Ioné Acquah. 19×25·5 cm. 176 pp. London: University of London Press. 1958. 50s.

The publication of more surveys of the character and value of *Accra Survey* would be most desirable, for though not strictly geographical they are the essential background to the proper study of tropical urban geography, which lacks the kind of material usually readily available for European urban studies. The survey covers history, population, residence, economic life, government, education, health and welfare, religion and recreation, with appendices of a case history and activities in community and neighbourhood centres. Its value is greatly enhanced by the conclusions drawn from an unpublished paper by J. Hubbard (formerly lecturer in geography in the University College of Ghana) and the good use that is made of his excellent map of urban land use. This book is of unique value for tropical urban studies at a time when there is such an explosive growth of cities in these regions—it is a pity it costs so much!

R. W. C.

**A Tobacco and Mixed Farm in Mashonaland, Southern Rhodesia.** Farm Study Scheme: Sample Studies of individual farms. Association of Agriculture. 21·5×38·5 cm. 24 sheets. London: Association of Agriculture and the Federal Dept. of Conservation and Extension, Rhodesia. 1959. 20s.

"Such excellent studies as those produced by the Association of Agriculture," said Miss I. V. Young (*Geography*, Vol. 44, 1959, pp. 107–17) "will go far to counteract unrealistic generalizations about farming." This is certainly true of this study of Imire, a tobacco and mixed farm in the Marandellas District of Southern Rhodesia, to the southeast of Salisbury. The study includes a useful account of the general geography of Southern Rhodesia which serves both as background and as extension to the detailed description of the farm. The teacher will learn more from these pages about Southern Rhodesia than from many text-books and will at the same time be acquiring valuable illustrative detail about farming conditions. There is proper emphasis on the unreliability of the rainfall in many districts; on the special difficulties of labour supply; on the still essentially pioneer nature of much Rhodesian farming (Mr. Travers, the farmer, has only recently settled his rotation after nearly fifteen years' experience); and on the fact that, though Imire is a tobacco farm, only about one-twentieth is under tobacco at any one time. Attention is directed to the peculiar

problems of growing and handling a tobacco crop and to the fascination of Salisbury's tobacco auction-floors, the largest in the world and now the source of about one-quarter of all the tobacco smoked in the United Kingdom. There are also accounts of the livestock on the farm—an indication of a new venture for a tobacco grower consequent upon the improvement of pastures and the adoption of a rotation. All these, and many other features, not only indicate the changing nature of Southern Rhodesian High Veld farming but also stress the contrast with those British agricultural practices with which most of us are more familiar.

The material in this study is clearly meant for the teacher: it is hard to see how it can be directly used by boys and girls. Perhaps, therefore, the somewhat haphazard order of the contents does not matter. It is strange, however, to find the historical background, referred to on sheet 1, as the very last section, while "the African scene: some flora and fauna" would also be more appropriately placed near the beginning than towards the end.

Maps of the rainfall and relief of Southern Rhodesia, good in themselves could be reduced in size and supplemented by other maps—perhaps of vegetation, farming types or the distribution of tobacco-growing. The photographs are carefully chosen and have reproduced well. The important air photograph of Imire farm is difficult to understand, and a clear sketch of the lay-out alongside the photograph, in place of the selective key, would have helped greatly. All in all, this farm study can be strongly recommended as unique background material for this part of the world. It is to be hoped that the Association of Agriculture will be encouraged to illustrate farms elsewhere in Africa in the same way.

E. M. S.

**This Sculptured Earth: the Landscape of America.** J. A. Shimer. 18 × 24 cm. xii + 255 pp. New York: Columbia University Press. London: Oxford University Press. 1959. 60s.

Greater mobility and prosperity are enabling Americans to see more and more of the varied landscapes within their three million square miles of territory. This has stimulated an increasing interest in the origin, development and regional distribution of landforms. Professor Shimer, a geologist, has recognized the layman's need for a guide to the geomorphology of the United States and his book is an attempt to satisfy this need.

The book's outstanding merit is the collection of over sixty admirably clear photographs. Over half of these are of landscapes to the west of the Great Plains, whilst most of the others are of New England. In contrast, most of the sixteen maps and diagrams are too limited in content to add much to the book's effectiveness. Concise definitions of most of the indispensable geological and geomorphological terms are contained in a ten-page glossary. However, the text is relatively non-technical in style.

This is a book to stimulate the interest of the non-specialist, especially the student with little background knowledge of the physical sciences. It should also increase the more advanced student's visual impression of the geomorphic diversity within the United States.

G. M. L.

**The Outer Banks of North Carolina 1584–1958.** David Stick. 15·5 × 23·5 cm. xii + 352 pp. Chapel Hill: University of North Carolina Press. London: Oxford University Press. 1958. 48s.

The outer banks are a line of sand islands enclosing a lagoon of very variable width. Cape Hatteras is almost the most easterly point, and is near the place where the Gulf Stream leaves the coast and turns out to sea. The Carolina banks are but part of a much longer series extending both north and south from that state. The

present book is a history of these banks, not in the sense of their formation and evolution, but in that of their occupation by man, for which the author has been at great pains to collect a wealth of material, tracing their story through the periods of European exploration, settlement, the American revolution, the Civil War, and onwards to the present time.

This is not a geographical work; it is a kind of local history together with a commentary on such diverse subjects as pirates, well-known characters, the first flight of the Wright brothers, cattle rearing, and fishing and fishermen. The last and long chapter, The Banks Today, contains a brief account of every island and settlement. The general reader may well regard the book as too limited in scope unless he happens to know the east coast of the United States, though the historical geographer will find a great deal of local interest.

There are some good bibliographical notes on all chapters, except that dealing with the natural features where reference is made only to people and departments and not to literature. There is a full index, and the book is well produced and contains four maps and some pleasant woodcuts at the heads of chapters.

J. A. S.

**The Industrial Structure of American Cities.** G. Alexandersson. 18·5×25 cm. 133 pp. London: George Allen and Unwin Ltd. 1956. 40s.

**Studies of Highway Development and Geographic Change.** W. L. Garrison and others. 20×26·5 cm. xvi+291 pp. Seattle: University of Washington Press. 1959. $7.50.

**Studies of the Central Business District and Urban Freeway Development.** E. M. Horwood and R. R. Boyce. 20×26·5 cm. xiii+184 pp. Seattle: University of Washington Press. 1959. $5.00.

These three books present the results of systematic studies of urban functional structure in the U.S.A. The first, published in 1956, has been many times reviewed though not hitherto in *Geography*, and this opportunity is taken to make good the omission. It consists largely of a series of maps showing the distribution by symbols of industrial workers, industry by industry, among the 864 towns of 10,000 or more inhabitants in 1950. The maps are compiled on a uniform statistical basis similar to that used for Professor William Olsson's *Economic Map of Europe*. In the text, discussion of the general problem of analysing urban population distributions is followed by brief but informative discussion of each industry in turn. The industrial functions of individual towns are discussed at appropriate points but no attempt has been made to present a synthesis of findings for the principal urban areas as such. Despite a rather abrupt ending and occasional obscurity of language, Dr. Alexandersson's work stands as a model of presentation to urban geographers, and as a valuable source-book for the study of the industrial geography of the U.S.A.

The other two works are companion volumes in a series of "Highway Economic Studies" prepared by a team of economists and geographers in the University of Washington as part of a research programme sponsored by the Bureau of Public Roads of the Department of Commerce and the Washington State Highway Commission. They deal with specialized planning problems in a purely American context and the methods of investigation are accordingly of limited general application. *Studies of Highway Development and Geographic Change* analyses the impact of road development on the location and success of retail and service business undertakings in relation to residential area development, daily travel and the like. Discussion ranges from a review of theories of spatial organization to description of individual case studies. The book is likely to be of more direct interest to planners than to geographers and it is regrettably written in ponderous style with much jargon and circumlocution. Nevertheless there is much to interest the specialist urban geographer.

*Studies of the Central Business District and Urban Freeway Development* is also mainly economic in interest but more lucidly written. It examines recent trends in the changing pattern of retail sales and office location in relation to road systems. A concluding chapter examines the practical problem of relating property taxation to road facilities. Both books are well produced, illustrated and referenced, but they will be of marginal interest to most readers of this journal.

A. J. H.

**The Canadian Northwest: Its Potentialities.** Symposium presented to the Royal Society of Canada in 1958. Edited by F. H. Underhill. Studia Varia Series. 15·5×23·5 cm. vi+104 pp.+map in end pocket. Toronto: University of Toronto Press. London: Oxford University Press. 1959. 32s.

This series of papers includes assessments from the standpoint of both the engineer and the geographer, and papers covering minerals and fuels, biological resources and the possibilities for future resource development. An historical introduction and a concluding essay on the problems of self-government add a refreshingly human angle to balance the sober realism of the other contributions.

Inevitably there is some overlap between the papers. Thus, three authors spend a good deal of space defining the area. In this respect, the geographer, William C. Wonders, makes a good case for defining the Northwest on the basis of transport facilities. By taking the railheads as the southern boundary, and limiting the remainder of the area to that served by the Mackenzie river and lakes system, a far more satisfactory region emerges. It omits the remoter portions of the District of Mackenzie but includes the Lake Athabasca area of Alberta and Saskatchewan. At the same time, the definition underlines the major problem that faces the whole region—the lack of transport facilities.

Each essay contains much of interest to the geographer, who will find within this book an up-to-date account of the resources and their possibilities. In particular, one might pick out R. F. Legget's account of building difficulties, A. H. Lang's masterly survey of the geological sub-provinces of the Shield and their associated mineral suites and D. S. Rawson's spirited plea for research in the biological field, which highlights an aspect of the northern environment that is too easily neglected.

This book should form a useful work of reference both for college students and sixth-form pupils, for not only does it deal with an increasingly important Canadian region, but in a wider sense, it also presents a picture of modern pioneering in cold climates.

K. R. S.

**New Zealand: A Regional View.** K. B. Cumberland and J. W. Fox. 22×14 cm. xvii+280 pp. Whitcombe and Tombs, Ltd., Christchurch. (London Office, 3–4 Addle Hill, Carter Lane, London, E.C.4.) 1959. 18s. 6d.

This book is not a systematic geography of New Zealand; it is essentially a series of essays descriptive of the regions into which the authors divide the country. It is the only book that deals reasonably comprehensively with this aspect of the geography of the Dominion and is a significant contribution to the geographical literature of the country. The authors' viewpoint is clearly indicated in an introductory chapter. Geography endeavours "to interpret, explain and account for the likenesses and differences between places". In the present context, "places" means the eleven regions that are distinguished and the four "metropolitan cities" of Auckland, Wellington, Christchurch and Dunedin. After a brief survey of the country as a whole, the "personality" of each region is expounded, based on the skilful marshalling of the relevant material, physical and human. There is much emphasis on the changes

in the New Zealand landscape since the early settlements of the *pakeha*, made little more than a hundred years ago, and there is a truly appalling account of the ruthless and in some ways disastrous clearing of "Eastland" where "the pioneers burned their way northwards from the Wairarapa". While there is, of course, much about sheep, cattle, wool, meat, butter and cheese, so important for most of the country, the very varied response in terms of land use to the different natural conditions and the present-day reaction of *pakeha* and Maori provide broadly the basis of the regional differentiation. For each region there are maps (some of which could with advantage be clearer) showing types of farming, place names, roads and railways, and population distribution, as well as a series of photographs which admirably subserve the regional aim of the book, especially as there is an appendix giving a note about each. The essays, with their abundant significant detail, necessarily throw much light on the general geography of the country and, as is shown by the bibliography, bring together the results of much research by New Zealand geographers and Government departments.

For the British reader, the book has certain limitations arising largely from its origin. Some years ago the Department of Education commissioned Professor Cumberland to supervise a series of regional studies for use in New Zealand's secondary schools; these were prepared by specialists. On their going out of print, and with the encouragement of the Department, the essays were re-written, added to and brought up-to-date in order to make a book that is directed primarily to the secondary school pupil. This has the advantage that the writing is clear and straightforward while the treatment is sometimes pleasantly informal. The text, however, frequently refers to things that are familiar enough to the average New Zealander but outside the experience of most British readers. A glossary for "foreign" readers would be an advantage. Again, some statements (e.g. Canterbury-North Otago has "a close network of roads and railways") need to be related to New Zealand conditions. By no means all the places mentioned are located on the regional maps; for a full appreciation of the text the reader needs at hand a good general map, with the relief clearly shown, such as that issued in two sheets by the Lands and Survey Department at the scale of 1 million. Even better would be the recently published *Descriptive Atlas of New Zealand* which has sectional maps on the same scale, an authoritative text and many special maps concerned with most facets of New Zealand geography.

New Zealand—small, isolated, young, under-populated—has already developed well-marked regional differences emphasized by the individual character of each of the larger cities. While the regions may as yet be immature, this account of their present stage of development will be welcomed by geographers.

L. S. S.

**John McDouall Stuart.** M. S. Webster. 22×14 cm. xiii+319 pp. Melbourne: Melbourne University Press. 1958. 42s.

One hundred years ago Stuart was approaching the summit of his achievements; six exploratory journeys in quick succession towards and then beyond the centre of Australia soon made him a national figure. But if his rise to fame was meteoric, so too was his decline, and within a few years, blind and enfeebled by the privations of his travels, he sailed for England where he died in 1866.

Stuart has been poorly served by posterity. A clumsy and inaccurate version of his collected journals, edited by Hardman of the London *Morning Post*, was published in 1864, but there has been no adequate biography until this, written by Mrs. Webster, who is herself descended from the explorer's brother, Samuel.

Details collected from many scattered sources have been employed, but Stuart's own journals and diaries, and Parliamentary Papers of the South Australian Government provide the bulk of the material. The treatment is chronological, progressing from his boyhood in Scotland to service as a member of Charles Sturt's expedition in South Australia, leading up to the journeys which Stuart himself organized and led.

No other Australian explorer concentrated his attention so frequently upon the same area as did Stuart; five times between 1859 and 1863 he made and retraced a trail from Adelaide towards Arnhem Land until he succeeded in crossing the continent from south to north to win a reward of £2,000 offered by the Government of South Australia. His route was closely followed some years later by the surveyors and engineers of the Overland Telegraph Line, which stands as a monument to his memory.

The text bears evidence of scholarly research and is well documented; some of the maps have suffered in the reduction to page size, the printing on these being minute, but the photographs are clear and the whole book is handsomely produced. It is a competent and sympathetic study, which does justice to a notable explorer.

L. J. J.

**The Earth and its Resources. A textbook for courses in physical geography and earth science.** 3rd edition. V. C. Finch, G. T. Trewartha & M. H. Shearer. 16·5×24·5 cm. viii+584 pp. London: McGraw-Hill Book Co. Inc. 1959. 46s. 6d.

Intended for use in American colleges and high schools, this book is written for the encouragement of pupils not yet sufficiently mature to use the perhaps better known textbook by the two senior authors and their associates at the University of Wisconsin.

The first edition was reviewed for this journal in 1942 (vol. 21, p. 114). The main criticism made then unfortunately remains true for this edition. An almost exclusive dependence on American source material and references to an almost entirely American set of examples of the phenomena discussed makes this book unsuitable for class work in Fifth or Junior Sixth forms in Britain. Nevertheless it would be unfair to exclude it from class libraries on this consideration alone. There are many good sections in the book useful for general studies. As supplementary reading for a course on the regional geography of North America the volume would provide an excellent revision of the material prepared for most physical geography sections of the Advanced Level General Certificate Examination. The climate section—the downfall of so many students—is exceptionally lucid and many interesting and easily remembered examples are given to demonstrate the importance of the physical factors which control the behaviour of the atmospheric pressure systems.

The small section on Earth resources is perhaps the least satisfying. These products are explained strictly in relation to the physical factors of their occurrence and with little reference to the effect of changing economic factors. For example, South Wales because of its location is inferred to be still a major exporter of coal abroad (p. 449). At the end of each chapter there is much useful material available for use in project work or in discussion, and an exhaustive series of questions ensures that the work done on each section is thoroughly tested.

The book has changed very little in form from the second edition published in 1948. A number of new references have been added, also a section on Jet streams (p. 172). A large number of new illustrations has been included and there has been a considerable improvement in the quality of reproduction of the photographs compared with the earlier editions. The very useful series of appendices have been re-arranged and enlarged; the section on visual aids for teaching purposes is now omitted. These changes have led to an error of reference on page 188.

R. H. J.

**Beaches and Coastlines**. C. A. M. King. 15×23.5 cm. xii+403 pp. London: Edward Arnold Ltd. 1959. 65s.

Dr. King has gathered together most of the more important coastal studies of the past few years and laced them with the results of her own research. The result is a valuable work of reference. It is as a tool for the research worker that this new study

must be judged since it is clearly not intended as a geographical text-book. Many undergraduates reading Geography will find the mathematical treatment, particularly of the chapters on waves and tides, beyond them.

The book suffers a good deal from repetition. For example, a long section on Waves in Chapter 1, The Main Factors on which the character of the beach depends is followed by Chapter 3, Waves, which gives much of the same material in greater detail. Similarly Chapter 4, The movement of material on the beach, deals with many factors repeated in Chapters 9 and 10. The effect is heightened by the numerous summaries and the repetition of references.

One of the very good features of the book is the attempt to link experimental work in models with full-scale trials on the open beach. There is, however, a tendency to minimize the limitations of model studies and to claim agreement with results on the coast when such agreement is lacking. On pages 208 to 213, for example, experiments, to discover the effects of onshore winds on the movement of sediment normal to the shore, are described. These were carried out in a narrow wave tank in which little allowance could be made for longshore displacement. The results are compared on page 215 with those obtained on the beach at Marsden Bay where longshore movement had clearly been of equal or greater significance than movement normal to the shore. The Marsden Bay profiles, in any event, did not extend below low water mark.

In the later chapters there are many errors of detail which seem to indicate inadequate checks and consultation. The suggestions on p. 217 that marram grass can withstand immersion in salt water and that sea buckthorn, dewberry and elder are its normal successors on stable dunes are both unrealistic. The remarks on page 270 that "Poole Harbour was almost completely colonized by (Spartina) between 1911 ... and 1924 when nearly all the bay was covered by it" are clearly nonsense since even in 1960 only about 5 to 10 per cent of the harbour is so covered.

Despite these criticisms which are all concerned with minor points, it remains true that Dr. King has produced a work of the first importance which reflects not only her stature as a research worker but also her skill as a compiler.

C. K.

**Surveying.** Pitman Engineering Degree Series. A. Bannister and S. Raymond. $14{\cdot}5 \times 22{\cdot}5$ cm. vii+438 pp. London: Sir I. Pitman & Sons Ltd. 1959. 45s.

Written for engineering students this book covers fully those branches of surveying which are in the special province of the engineering surveyor: chain surveying, levelling, measurement of areas and volumes, tacheometry and curve ranging are exhaustively dealt with. In a book as compact as this, something is bound to be curtailed and here it is mainly those subjects which are taught in most university departments of geography: plane tabling, compass and barometric traversing and the principles of triangulation. However, in all sections adequate reference is made to other texts for additional information.

That the book is not written for the student of geography becomes apparent on reading that "the possession of a mathematical background is an advantage". Such a background is not always part of the stock-in-trade of the geographer, and one might well substitute "essential" for "advantage" when it is found that familiarity with differential calculus and radian measure, for example, is assumed. On the other hand, it is surprising to find on page 72 the definition and properties of a contour line explained at some length.

Recent trends in instrument design and techniques of surveying are outlined, mention being made of the geodimeter, tellurometer, modern theodolites and levels and the advantage of the centesimal system, but one deplores the use of 'a.m.' and 'p.m.' (as on page 407) rather than the 24-hour clock in booking astronomical observations.

Each chapter ends with suitable examples of surveying problems, and the book with an adequate index. D. J. H. S.

**The Ordnance Survey Annual Report 1958–59.** 21 × 33·5 cm. 22 pp. + 12 maps. London: Her Majesty's Stationery Office. 1959. 6s. 6d.

Everyone who is fond of maps will find much of interest in this brief report on progress in the work of mapping Great Britain. It is well worth borrowing from a library; many teachers will conclude that it is worth buying for the Geography Department's library. Such a decision could well be due to an appreciation of the Report as providing a fresh approach to map study—one concerned with the fascinating detail of the preoccupations, the "inside, domestic affairs," of a great survey and cartographic organization. The contents with their brief but suggestive allusions to many aspects of the modern ways of making a map, may well rekindle the spark in any somewhat blasé Sixth-Formers.

There is news that the Second Series of the 1/25,000 map will be produced in much larger sheets, to cover 20 × 15 km., after the completion of the First Series in 1961. Another item, inter alia, is that another "period" map is to be expected early this year—"Southern Britain in the Iron Age". All maps published within the year are mentioned and brief notes given on cartographical innovations. A noteworthy recent issue is a Quarter-Inch map covering all Wales and the Marches. The state of revision of maps of districts in which one is interested can be found in the appended key maps.

As this publication is being recommended for schools one must note, for correction on receipt, the printer's error on page 13, line 3, for it produces an all-too-common misspelling. F. J. C.

**Arid Zone Research—XII. Arid Zone Hydrology: Recent developments.** H. Schoeller. 15·5 × 24 cm. 125 pp. Paris: U.N.E.S.C.O. 1959. 12s. 6d.

In 1952 Unesco's Arid Zone Research project published two volumes on hydrology, since when the series has included digests on climatology, the use of saline waters, and human, animal and plant ecology. The present volume is the first of a slightly different type of publication, bringing the existing digests up to date and containing a full bibliography. There are short chapters on the formation of groundwater reserves and their replenishment in arid zones; on groundwater prospecting and development; and on the calculation of permeability and transmissibility from pumping tests. Almost a third of the pages concern the geochemistry of groundwater—water from the main types of rocks—and more significant researches in Russia into the influence of our large well-recognized climatic zones on the chemical composition of stored groundwater. The last chapter concerns the use of radio-active tracers in circulation investigations, one important result being an accurate diagram of the water cycles in the Mississippi valley.

Since elementary chapters on groundwater are making their appearance in textbooks, this volume could be used in advanced classes to illustrate the kind of work which is at present proceeding, but it assumes familiarity with jargon such as can only be gained from reading the accepted manuals, such as Meinzer or Tolman.

R. W. C.

**Natural resources.** 2nd edition. University of California Engineering Extension Series. M. R. Huberty & W. L. Flock (Editors.) 15 × 23·5 cm. xviii + 556 pp. London: McGraw-Hill Book Co. Inc. 1959. 85s. 6d.

A growing tendency among thoughtful Americans to assess the world's material resources, their use and their conservation has become particularly apparent during

the last decade. The publication of the Paley Report (1952), which focused attention upon the United States' gargantuan appetite for materials and the fact that that country was no longer a raw material surplus nation, but a raw material deficit one, reinforced the attention paid to this subject. This substantial and expensive book is an addition to such literature and stems from a lecture series given by leading authorities at the University of California, Los Angeles in 1955, sponsored by Engineering Extension. Each has contributed a specialist chapter in a close survey of all major natural resources of the earth's land, water and atmosphere.

The theme underlying the whole work is brought out in a sober introductory chapter entitled "Natural and Human Resources". This chapter, presenting the world's population problems from new viewpoints deserves to be read widely. The need for rationalized population policies is demonstrated, and then the author (Varden Fuller, Professor of Agricultural Economics) using United States' consumption as a yardstick turns to consider the rate of use of resources in relation to the growth of population and the rise in standards of living during the next few decades. The maintenance of prosperity and full employment requires substantial investment, thus as the magnitude of the economy grows, so must total investment. An unrelenting upward spiral is envisaged with ever greater resource needs. Democratic governments pledged to prosperity and full employment can do little to impose restraint. It would seem this must come from the people's understanding of the situation, from a broadening of moral consciousness and an awareness of the interrelation between personal behaviour and aggregate consequences. These problems are taken up again in the penultimate chapter which considers the economic bases of conservation policies.

Inevitably, with a team of over twenty experts, there are differences of level between the chapters and many would appear to be above the general public who as the preface hopes, as well as "students, engineers, scientists and educators", will read the book. Among the specialist chapters those on "Ecology, Wildlife, and Wilderness", "Soil", "Land as a Resource", "Food Consumption and Resources" are suited to the general reader, whereas chapters on photosynthesis, nuclear energy and geophysical aspects of mineral exploration become more technical. This is not a book for the school library, but deserves a place in every university department of geography.

A. B. M.

**Conservation of Natural Resources.** 2nd edition. Guy-Harold Smith. 19×25 cm. xi+474 pp. New York: John Wiley & Sons, Inc. London: Chapman and Hall Ltd. 1958. 68s.

In this revised and slightly enlarged edition of the work first published in 1950, one new chapter on economics and conservation has been added and five other sections have been re-written. Nineteen authors, including the editor who has written five of the 23 chapters, have contributed essays each on some aspect of conservation in the U.S.A. Reference to conservation in other parts of the world is excluded; the title is therefore somewhat misleading. Nevertheless as an introduction to conservation in general this is a very useful and interesting compilation. Conservation in relation to agriculture, forestry, water supply and control, minerals, fauna and man himself are included and in addition there are essays on the history and planning of conservation in America. In short the aim of this book is to present the major acts concerning the many aspects of the conservation of natural resources in a readable and readily understandable form and in this aim success is very largely achieved.

Novel approaches are not to be expected here and thus the book is to be recommended rather as a review of knowledge in this field than as a presentation of new ideas. It may serve too as background reading to the study of natural resources in courses on economic geography and on the regional geography of the U.S.A.

The maps and illustrations are good and there are adequate references to further reading at the end of each chapter E. M. R.

**Geography of Commodity Production.** R. M. Highsmith and J. G. Jensen. 18×25·5 cm. xvi+462 pp. Chicago: J. B. Lippincott Company. 1958. $6·00.

Excluding a seven-page introduction, this book is divided into four parts: I—Commodities derived from agriculture; II—Commodities derived from sea and forest; III—Commodities derived from mining; IV—Commodities derived from manufacturing. Each part consists of an introductory section, where the supposedly relevant "geographic factors" are examined, followed by a series of essays each dealing with one commodity or with a group of commodities, e.g. vegetable oils, light metals. The order of presentation in the essays is consistent—introduction, factors of production, areas of production, world trade—but, although this method allows no continuity of argument from one essay to the next, no attempt is made either at the end of each part or at the end of the book to draw general conclusions and formulate principles applicable to the location of commodity production. Indeed the last two pages of the text deal with the production of beer, and the final sentence reveals the important fact that the United States alone accounts for a third of the world's output.

This is a factual reference or course book suitable for use where an orderly presentation rather than a critical evaluation of facts is required to achieve a creditable standard. The factual basis appears generally sound; salient features are usually appropriately emphasized; there is little padding, and there are many references to specialized and more critical sources. The book adds little to knowledge. Its virtues are orderliness and simplicity.

A few minor errors are permissible in a book of this kind but the synonymous use of "general" and "geographic" cannot be allowed to pass without comment. In both the preface (page vii) and the introduction (page 7) each of the four parts is said to be introduced by chapters presenting the *general factors* influencing production, while in the titles of the chapters concerned the term *geographic factors* is substituted. As a description of the contents of these chapters neither adjective is necessary and *geographic* is wholly inappropriate. This error largely explains why the least satisfactory sections of the book are those not directly concerned with any particular commodity.

E. M. R.

**The Changing World: Studies in political geography**. W. G. East and A. E. Moodie (Editors). 16×23 cm. xxvii+1040 pp. London: G. G. Harrap & Co. Ltd. 1956. 42s.

**World Political Patterns.** L. M. Alexander. 15·5×23·5 cm. xii+516 pp. London: John Murray. 1957. 55s.

Political changes since the second world war have been so great that their objective analysis from the point of view of the geographer, such as is attempted in these two books, is timely. Many detailed but separate studies in regional political geography have been made in recent years but there is also need for synoptic views of world affairs of the kind that are given here. The two books differ in approach and arrangement, but are complementary, and each invites comparison with Dr. Isaiah Bowman's notable survey *The New World* which first appeared nearly forty years ago.

No fewer than twenty writers, drawn from five countries, contribute to *The Changing World* and their specialized knowledge of particular areas or themes provides authoritative surveys. Inevitably there is some variation of style and treatment in these essays, but that is not undesirable in a work of this length, and the advantages of having a team of specialists are obvious. In world studies of this type the change

of emphasis since Bowman's time is reflected in the allocation of space. Writing soon after the conclusion of the Treaty of Versailles, Bowman devoted about three-fifths of his book to Europe and gave relatively little space to the Americas and none to polar problems. By contrast, about one-quarter of the present book deals with the Americas, rather more than one-quarter with Europe and nearly one-third with Asia. In addition to sections dealing with Africa and Australasia there are chapters on the Arctic, the Antarctic, maritime boundaries and the geographical aspects of the world's food problem. The text is usefully supplemented by statistical tables and many clear informative maps and diagrams. Each chapter or section concludes with recommendations for further reading and thus suggests ways of overcoming limitations of space which are necessarily imposed by the character and scope of this book. It is an important work which should achieve substantial success.

*World Political Patterns* is intended to serve two purposes: "as an introduction to political geography and as a presentation of the geographic basis of international affairs". It succeeds in both respects, but chiefly in the latter. Two introductory chapters briefly examine the nature and development of studies in political geography and attempt an analysis of the basic elements in any political region. The studies in regional political geography which form the bulk of the book consist of clear and succinct factual surveys, but some of the selected areas bear unusual titles. Thus, the term "Central Africa" is applied to everything between the Sahara and the Limpopo, and "The Two Chinas" refers to mainland China and Taiwan. The book concludes with a summary of general aspects of the world's political patterns and discusses the position of the United States with respect to the Cold War. Professor Alexander's declared aim of producing a concise book "suitable for teaching purposes" has in many respects been achieved, but the intensive use of captions, sub-headings and short paragraphs does not enhance its style. Bibliographies are given and maps are numerous and clearly drawn but those that attempt to show physical features add nothing to what even an elementary atlas would provide.

Both books form admirably clear summaries of extensive factual data and provide valuable reading for all who seek dispassionate and informed comment on the constantly changing political patterns of the world.

A. McK. F.

**How People Live Series.** A. E. Tubbs (general editor). **Norway.** W. R. Mead. 100 pp. **Australia.** A. J. Rose. 102 pp. 17×21·75 cm. London: Educational Supply Association Ltd. 1959. 8s. 6d. each.

These are the first two titles in a new series for schools which sets out to present sample studies drawn from the most important regions of the world. Both books provide a short book-list for further reading and titles of relevant filmstrips published by Common Ground Ltd. They are attractively produced on good quality paper and contain detailed information not easily available to teachers outside the countries concerned. Bold line-drawings, diagrams and sketch-maps could be duplicated by the teacher for use in class. It is doubtful whether many schools will be able to afford class sets of these books, but this in no way detracts from the undoubted usefulness of their contents to teachers who wish to introduce one or two sample studies per term into their geography courses.

L. J. J.

**A Geography of Scotland** by G. Rae and C. E. Brown. This book, listed on p. 277 of *Geography*, vol. xliv, November 1959, was published by G. Bell and Sons Ltd.

**Groundwork Geographies** by N. Jackson and P. Penn, also listed in that issue, was published by G. Philip and Son Ltd.

# Geographical Articles

*Listed from Periodicals received in the Library*

CONTINUED FROM VOL. XLIV, PP. 217 TO 220

Journals listed here may be borrowed from the Library by members of the Association in the British Isles. References are listed according to the classification published in the *Annals of the Association of American Geographers*, vol. xxvii, June, 1937. Authors' reprints presented to the Library are included in the list of articles.

A—Australian Geographer. AG—Acta Geographica. A of G—Annals of the Association of American Geographers. A of Sc—The Advancement of Science. AUCS—Annales Universitatis Mariae Curie-Sklodowska. BAGF—Bulletin de l'Association de Géographes Français. BE—Bulletin de la Société de Géographie d'Egypte. BG—Boletim Geografico. CGQ—Cahiers de Géographie de Quebec. EG—Economic Geography. EMG—East Midland Geographer. FO—Focus. GA—Geografiska Annaler. GB—Geographical Bulletin, Ottawa. GJ—Geographical Journal. GN—Geografiska Notiser. GNS—Geografia nelle Scuole. GR—Geographical Review. GRI—Geographical Review of India. GSI—Geographical Society of Ireland, Irish Geography. GT—Geographisch Tijdschrift. GV—Geografski Vestnik. IBG—Papers of the Institute of British Geographers. IGJ—Indian Geographical Journal. J of G—Journal of Geography. JRCS—Journal of the Royal Commonwealth Society (formerly United Empire). KGA—Kölner Geographische Arbeiten. LG—La Géographie (Belgium). MO—Marine Observer. NG—New Zealand Geographer. OG—Oriental Geographer. PG—Przeglad Geograficzny. PGA—Proceedings of the Geologists' Association. PGR—Pakistan Geographical Review. RGA—Revue de Géographie Alpine. RGL—Revue de Géographie de Lyon. SGM—Scottish Geographical Magazine. T—Terra.

(E)—English summary. (G)—German summary. *—Maps.

**GENERAL GEOGRAPHY**. L. V. BERKNER, GR, Vol. 49, July '59.—Geography and space. K. C. EDWARDS, EMG, Dec. '59.—The Humboldt and Ritter centenary. J. W. FOX and G. R. LEWTHWAITE, NG, Vol. 15, Apr. '59.—Methodological viewpoint. 1. For Geography: A review and commentary. A. GROTEWOLD, EG, Vol. 35, Oct. '59.—Von Thunen in retrospect. L.-E. HAMELIN and others, CGQ, No. 5, '58–'59.—Applied geography (in French). C. HSIEH, GR, Vol. 49, Oct. '59.—The status of geography in Communist China. G. JOBBERNS, NG, Vol. 15, Apr. '59.—Of many things (Presidential address.). F. L. KRAMER, GR, Vol. 49, July '59.—A note on Carl Ritter 1779–1859. K. A. SINNHUBER, SGM, Vol. 75, Dec. '59.—Carl Ritter 1779–1859. K. A. SINNHUBER, SGM, Vol. 75, Sept. '59.—Alexander von Humboldt 1769–1859. S. VAN VALKENBURG, A. of G, Vol. 49, Dec. '59.—Charles F. Brooks, 1891–1958. A. A. WILCOCK, A, Vol. 6, June '52.—This is not geography. W. A. WOOD, GR, Vol. 49, July '59.—George Hubert Wilkins.

**CARTOGRAPHY AND MATHEMATICAL GEOGRAPHY.**—J. C. BHATTACHARJI, GRI, Vol. 21, Mar. '59.—Height. S. DAS-GUPTA, GRI, Vol. 21, Mar. '59.—New scribing method of drawing maps. C. N. FORWARD and C. W. RAYMOND, EG, Vol. 35, Oct. '59.—Small-scale land use mapping from statistical data. S. K. GHOSH, GRI, Vol. 20, Dec. '58.—Photogrammetry and some salient points for its application in mapping. A. K. SEN and S. CHAKRABORTY, GRI, Vol. 20, Dec. '58.—Selection of appropriate legends for soil and land use maps. W. R. TOBLER, GR, Vol. 49, Oct. '59.—Automation and cartography.

**PHYSICAL GEOGRAPHY**. J. BLACHE, RGA, Vol. 47, No. 3, '59.—On a network of glaciated troughs (in French). R. CARALP, RGL, Vol. 35, No. 1, '60.—A new theory on hail (in French). I. P. GERASSIMOV and E. N. IVANOVA, GRI, Vol. 20, Dec. '58.—Three scientific schools dealing with the general questions on soil classification and their mutual connexions. C. KIDSON and A. P. CARR, GJ, Vol. 125, Sept.–Dec. '59.—The movement of shingle over the sea bed close inshore. M. Cl. KLEIN, BAGF, Mar.–Apr. '59.—Surfaces polygéniques et surfaces polycycliques. H. LEHMANN, RGL, Vol. 35, No. 1, '60.—Classic terminology of Karst and modern climatic morphology (in French). G. M. LEWIS, IBG, No. 26, '59.—Recent American contributions in the field of landform geography. J. MASSEPORT, RGA, Vol. 47, No. 4, '59.—Laboratory experiments on rocks (in French). M. Ph. RENAULT, BAGF, Mar.–Apr. '59.—Morphogénétiques des karsts équatoriaux. H. J. WARMAN, J of G, Vol. 58, Oct. '59.—Panofsky's theories of climate change.

**TEACHING.** J. K. ANTHONY, J of G, Vol. 58, Sept. '59.—Geography quiz book. C. I. BAHN, J. of G, Vol. 58, Feb. '59.—Moon maps. L. BEAUREGARD, CGQ, No. 5, '58–'59.—Geography in normal schools and special schools of Quebec (in French). C. W.

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